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A review of online survey methodology in aquaculture culture consumer research

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ABSTRACT

Aquaculture is currently the fastest growing food sector in the world. Therefore, research in this sector plays a significant role in its development. However, one of the major constraints in its development is the frequent improper use of data and methods for analysis. Nonetheless, knowledge production in this field is accelerating and depends greatly on the data collection methods, one of which is online surveys. Online survey research is a prevalent methodology that is widely used in various disciplines in consumer studies, yet several methodological issues still persist. To assess the extent to which aquaculture researchers utilize online surveys in their consumer studies, scientific publications during the period 2014-2021 were reviewed. Scopus and Web of Science engines were used to search the current literature, and 21 studies were identified for inclusion. The review investigates the evolution of science using online surveys in aquaculture. In particular, with the focus of consumer studies, the review identifies and discusses strengths and weaknesses of online survey research as a methodological approach in aquaculture consumer studies and provides practical recommendations and implications for practitioners using this methodology as well as considerations for future studies. The review indicated that online consumer research in aquaculture is still a new and developing concept; however, specific strengths and weaknesses to the methodological approach were observed.

Keywords: Aquaculture, Online survey, Data collection, Consumer behaviour

INTRODUCTION

Aquaculture has since been growing rapidly over the last decades and is currently the fastest-growing food sector in the world (Morgan, et al., 2017) (Vanhonacker, et al., 2011). It is an essential food sector that produces a resourceful food commodity and a vital food protein for billions of consumers' worldwide (Belton et al., 2018) (Calanche, et al., 2020) (FAO, 2018). The World Bank projected that 62 percent of all global fish consumed in the year 2030 would occur in aquaculture (Kato and Freitas, 2015).

According to (Shang, 1985), research in aquaculture plays a significant role in its development. In other words, knowledge development in a discipline is vital in ensuring its future growth (Peighambari, et al., 2016). Research is essential for decision making and formulating aquaculture policies (Shang, 1986). Since aquaculture is a multidisciplinary science, a broad range of research is necessary to develop innovative operating systems and improve current management practices. Based on data from Scopus, 2021, the total scientific production in this sector has exponentially increased over the years, a totally of 58,718 research productions from 1875 to July 2021 (Scopus, 2021). A summary

of this trend is demonstrated in Figure 1. However, of these 58,718 scientific productions, 0.08% (46 records) employed an online survey methodology. Shang, 1986, further stated that the absence of adequate data for economic assessment in aquaculture is a significant problem since technology in this sector has been developed expansively instead of scientific research.

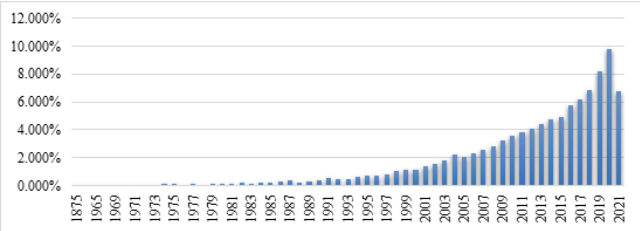

Figure 1: Growth trend of scientific publications in aquaculture (1875-2021).

The most common data collection method, among several others used in scientific research to collect primary data is survey. Surveys can be categorized into manual and electronic (Nayak and Narayan, 2019) (Vehovar and Lozar Manfreda, 2008). Survey as a research methodology has two main purposes: to measure attitudes and opinions and achieve knowledge of a social problem. In addition, surveys are becoming an essential research tool that is often used to analyse behaviour in sociology, psychology and consumer behaviour (Chrysochou, 2017) (Nayak and Narayan, 2019) (Vehovar and Lozar Manfreda, 2008). Therefore, the production of knowledge depends to a large extent on the methods for collecting, analysing, and interpreting data and their application (Pinsonneault and Kraemer, 1993) as in the development of aquaculture. Hence, data is of the utmost importance for research. However, researchers in different disciplines such as aquaculture may be oblivious of the benefits and drawbacks linked to conducting survey research online as online survey research is still young and developing (Nayak and Narayan, 2019). In fact, it is confirmed that several major methodological issues of online surveys persist today. Therefore, practical assessments of online survey research are needed to strengthen its quality and effectiveness (Vehovar and Lozar Manfreda, 2008).

In the 1930s, surveys became a standard instrument for empirical studies in official statistics, social sciences and marketing (Vehovar and Lozar Manfreda, 2008). Market research increasingly use surveys to seek out information about the reactions of real people to current and projected products and services (Groves et al., 2011) (Nayak and Narayan, 2019). In aquaculture, marketing and market studies of species is a significant area that influences aquaculture development and economic feasibility (Shang, 1986). According to (Kinnucan and Wessells, 1997), “market-driven aquaculture requires an intimate knowledge of consumers” wants, perceptions, beliefs, habits, attitudes, lifestyles, and other factors that govern choice”. However, one of the major constraints for economic study in aquaculture is the frequent improper use of data and methods for analysis (Shang, 1986).

Henceforth, we assess the state of scientific research from the year 2014 to July 2021. First, this article assesses the application of online surveys as the methodological approach in aquaculture consumer research through a review of scientific publications. In addition, the authors examine to what extent and measure the research questions were answered. Second, an analysis of the methodological approach’s main strengths and weaknesses specific to the studies in aquaculture consumer research derived from the review was discussed, following possible recommendations and implications. This article focuses specifically on consumer related studies in aquaculture that employed online surveys as its methodology to further contribute to the market-driven development of aquaculture through the improvement and application of quality online consumer studies in this developing sector.

So far, it seems that no one has carried out a review that aims at analysing online surveys as a methodological approach in aquaculture consumer research. In order to fill this gap, this review combines and organizes the main findings of online survey methodology in aquaculture consumer research.

LITERATURE REVIEW AND THEORETICAL FOUNDATION

The key element of all research, whether it is quantitative or qualitative, is to explain phenomena. Therefore, quantitative research is essentially a type of research explaining a particular phenomenon through the collection of numerical data (Sukamolson, 2007) (Williams, 2007). There are various types of quantitative research methods that employ strategies for investigation, such as survey research, experimental research, correlational research and casual-comparative research. Among the several types of quantitative research mentioned, survey research is prevalent and is now in vogue. In fact, since 1990, the use of electronic surveys has increased exponentially and has become popular in social sciences as a means of data collection and research subject (Barrios, et al., 2011) (Fricker and Schonlau, 2002) (Sukamolson, 2007) (Williams, 2007).

Survey research systematically gathers information from respondents within a specific population through scientific sampling and a pre-designed questionnaire instrument that yields statistical data. In addition, survey research allows comparisons between groups. Thus, sampling can be broadly grouped into probability based sampling (random sampling) and non-probability sampling (convenience sampling) (Fricker, 2017).

A survey process consists of four basic sequential stages (Figure 2). A survey design is primarily required in the first stage, consisting of the sample selection and the survey medium (online, written or verbal). Then, following the survey instrument development stage, which considers the study focus, the study objectives and types of questions to be asked. The survey instrument is then executed in the third stage. In addition, pilot surveys are recommended in the survey execution stage to first test the survey instrument and procedure prior to the actual survey implementation. Lastly, in the final stage, data analysis and reporting of results are conducted (Glasow, 2005).

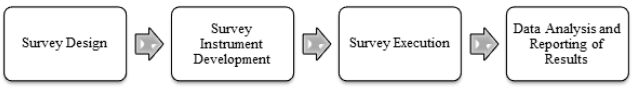

Figure 2: Flow chart summarizing survey process.

Surveys that are utilize paper-based methods such as written and verbal (face-to-face interviews or conversations, distribution of questionnaires, etc.) are subject to measurement error when untrained interviewers are employed. Similarly, the data conversion from paper-based to an electronic form for data processing and analysis is inefficient and results in poorer data (Glasow, 2005) (Nayak and Narayan, 2019).

On the other hand, an online or internet-based survey has several known advantages such as lower cost to conduct, less effort to administer, easier to execute, can yield better, faster response rates (Fricker, 2017) (Fricker and Schonlau, 2002) (Ilieva, et al., 2002) (Schonlau, et al., 2002). Though there is minimal coverage error associated when utilizing only online surveys, in order to eradicate or reduce this error, the target population must have easy and frequent internet access to complete the survey in addition to being adequately computer literate (Fricker, 2017).

Online Surveys and Its Relevance to Consumer Studies

Over the past 50 years, consumer behaviour has always been an area of significant interest for researchers. Moreover, consumer behaviour analysis represents one of the most significant marketing activities carried out by businesses today. Therefore, consumer behaviour research is the foundation of successful and effective marketing (Furaiji and Łatuszyńska, 2012) (Peighambari, et al., 2016). Consumer survey research aims to examine the characteristics of a target population and understand and predict certain aspects of their behavioural patterns, namely perceptions, attitudes, opinions, beliefs, and motives of the phenomenon under study. Subsequently, inferring information about the entire population; this strategy is associated with a deductive research approach (Barrios, et al., 2011) (Chrysochou, 2017) (Fricker, 2017) (Sukamolson, 2007) (Williams, 2007).

However, each consumer behaviour research project is likely to have its own advantages and weaknesses that the researcher needs to consider carefully. For example, the application of survey research in consumer behaviour is less appropriate to explore behaviour regarding a phenomenon whereby the consumer may have difficulty remembering the studied behaviour. However, survey research is most suitable to collect opinions on consumer behaviour (Chrysochou, 2017). Notably, an online survey is a valuable tool in preparing, collecting, and storing data, but several strengths and weaknesses still exist despite its advancement in data collection (Chrysochou, 2017) (Nayak and Narayan, 2019) (Vehovar and Lozar Manfreda, 2008). That is why the researcher needs to employ the online survey tool based on the study setting, population and methodology (Nayak and Narayan, 2019). Furthermore, the appropriate method chosen to conduct a survey is heavily dependent on the current situation the researcher is facing, including the limitations and strengths of the methodological approach (Chrysochou, 2017) (Nayak and Narayan, 2019).

In consumer studies, literature assessments can provide insights into contributions and published works to a specific field. Therefore, assessing the knowledge growth status of a discipline is essential in ensuring its future development (Peighambari, et al., 2016). The remainder of this paper is structured as follows. The Methodology section describes the searching criteria of research publications and the method used to gather information from a representative sample of studies. Second, the Results section first provides a general measure and analysis of the science and then reports the main methodological findings as per the review's research questions relating to online survey consumer behaviour research in aquaculture. The Recommendations and Implications section provides suggestions for improving online survey practices in aquaculture. Followed by the limitations derived from this review and considerations for future studies. The Conclusions section draws on conclusions on the main findings.

A detailed empirical review of published online survey research in aquaculture was performed in July 2021. The records searching criteria on online surveys and aquaculture was conducted using a combination of keywords in the two most powerful online scientific research engines: Scopus and Web of Science. We restrict our review to Scopus and Web of Science to keep the task manageable. Furthermore, we chose these two engines because they are comprehensive, global outlets for publications. Scopus and Web of Science are two database platforms that complement each other. In comparison to the other platforms, they are the main sources for citation data today. They offer a more extensive list of sources and in-depth citation by source (Mongeon and Paul-Hus, 2016).

The method used to identify and select the articles for this review is shown in Figure 3. In particular, Boolean operators were used to combining two primary keywords, “online” AND “survey” and “aquaculture”. In total, 77 articles were initially selected from Scopus [n=46] and Web of Science [n=31]. All searches were performed within the topic search field, including the article title, abstract and keywords. Before the screening process, the searches were further limited to research papers with Open Access (OA), resulting in a total of 43 articles: Scopus [n=25] and Web of Science [n=18]. After excluding duplicated records obtained from both databases (n=15), the list of records retrieved for screening was reduced to 28. All 28 records were further reviewed based on information contained in both the abstract and in the full text. This detailed evaluation led to the exclusion of 7 records that were ineligible based on three reasons: (i) the study was not focused on aquaculture products, (ii) the study applied secondary data as opposed to primary data, and (iii) the survey was not conducted online. As a result, the final sample for this literature review included 21 articles (Clarivate, 2021; Scopus, 2021).

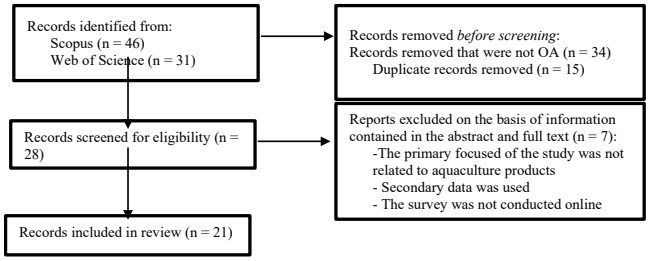

Figure 3: Flow chart summarizing article selection process.

Thereafter, we discovered that only 6 of the 21 publications focused on consumer behaviour analysis. The authors have conducted this research intending to make the study more descriptive in nature. Therefore, the second part of this review focuses on the analysis of the retrieved consumer publications. The study analysis illustrates the methodological strengths and weaknesses based on the consumer publications in aquaculture, identify possible gaps in the methodology, and provide recommendations for future developments in this research area.

DISCUSSION

An assessment of publications uncovers the trends and issues that impact a discipline (Peighambari, et al., 2016). Henceforth, our overall assessment of research in aquaculture, which applied online survey as its methodology, indicated that the quantity of online survey research studies is inadequate. Nevertheless, our review revealed that the total number of records collectively published from both databases which implemented an online survey methodology in aquaculture was over seven years, from 2014 to July 2021. Figure 4 illustrates the evolution of online surveys in aquaculture and demonstrates that there has been a constant growth in the usage of online survey research in aquaculture, mainly in the years 2018 to 2021. Moreover, the application of this research theme in aquaculture has displayed a significant yet constant growth spike from two online surveys (9.6%) in 2018 to six (28.6%) in 2019, increasing 200%.

Figure 4: Number of online surveys published from 2014 to July 2021.

The 21 records retrieved are summarized in Table 1, which provides information regarding the author(s) and publication year, the objective of the research, the type of respondents, the country(s) or regions where the study was conducted and the sample size of each study. The first two published online survey research in aquaculture was conducted in 2014 by Murray and Watson in order to assess worldwide biodiversity in hobbyist aquaria, and the second was conducted in the US and internationally to document and evaluate the production techniques, experiences, motivations, and demographics of aquaponics experts(Love, et al., 2014). This trend was followed by an additional two publications in 2015 on aquaculture production and educational means in the area of aquaculture (Love, et al., 2015) (Seixas, et al., 2015). Similarly, one article was published in 2016 and two in 2018 describing re-search and production of aquaponics and sturgeon life history, management and conservation by aquaculture stakeholders, and evaluating the effect of aquaculture social media Facebook community group in the devel-opment of aquaculture knowledge and financial health (Elfitasari, et al., 2018) (Jaric et al., 2018) (Villarroel, et al., 2016).

There has been a shift in the principal purpose for on-line survey research in the past years. Before 2019, aquaculture stakeholders such as farmers, workers, experts, professionals, businesses and researchers were the principal sample population of online surveys. In the year 2019, the first three studies in consumer behaviour were published together with one publica-tion evaluating river fish biodiversity, another two ex-amining the perception of live prey feeding aquatic an-imals and investigating the occupational hazards, risk assessment practices in aquaculture (Kochalski, et al., 2019) (Marques, et al., 2019) (Marshall, et al., 2019) (Van Osch, et al., 2019) (Yi, 2019a, 2019b). Followed with four publications in 2020 assessing risk factors re-lating to aquaculture farms, consumers perception of aquaculture products as “factory-made” or “farm fresh”, vulnerabilities per supply chain step and the demand for carp (Ali, et al., 2020) (Marvin, et al., 2020) (Rick-ard, et al., 2020) (Zander and Feucht, 2020). Finally, in 2021, four online survey research was conducted on farms,

organizations and fish consumers reporting the effects of the pandemic on aquaculture sectors, coral transplantation and consumers intention to consume fish (Azra, et al., 2021) (Ferse, et al., 2021) (Loncaric, et al., 2021) (Senten, et al., 2021).

As mentioned, the year 2019 was the peak of online survey research in aquaculture in general and the first studies relating to consumer behaviour. It is important to realize that, in 2020, the world was amid the coronavirus pandemic, which created significant restrictions specifically in the collection of data (face to face surveys, interviews and observations) this is primarily due to the preventive health measures declared by the World Health Organization, such as isolation and maintaining a minimum of 1 meter (3 feet) of the distance between yourself and others (WHO, 2020).

Based on our findings, most of the studies that applied an online survey in aquaculture research were representative of a worldwide or international sample (18.8%). However, the most productive countries or regions where this type of research was conducted were United States (12.5%), Norway (9.4%), Europe, Germany, the UK and South Korea (6.3%) (Figure 5). Thus, most online surveys conducted during this period were associated with aquaculture management or production related aspects (Table 1).

According to the findings, online surveys are not a popular research methodology for aquaculture consumer research; as seen in Table 2, online surveys in this area of research are relatively new compared to the other subject or research areas. Nonetheless, the most studied topic within the six consumer publications in aquaculture is consumer relationships and willingness to pay, each covered in 33% of the publications, followed by consumer perception and demand with 17%, respectively. A summary of these results is shown in Table 2.

In consumer behaviour research, aquaculture is not

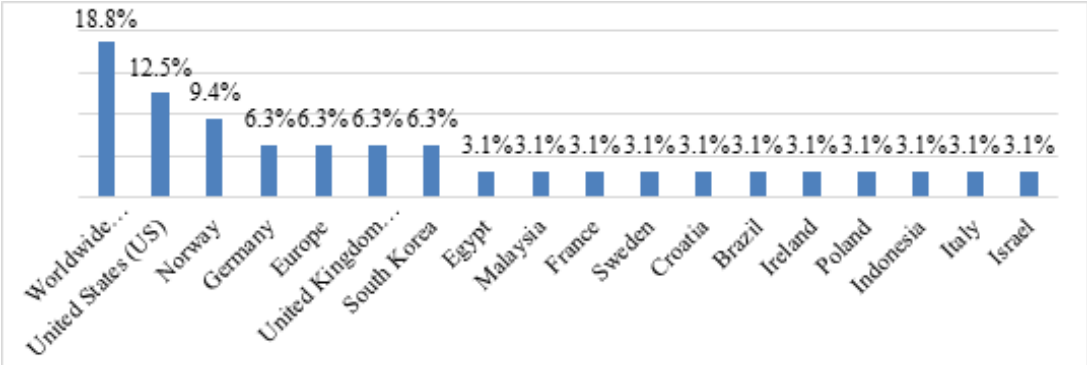

Figure 5: Publications of online surveys in aquaculture by country or region where the study was conducted (%).

Table 1: Synopsis of online scientific publications in aquaculture (2014-July 2021).

No.	References	Purpose/Focus	Respondents/Object of measurement	Country/ Region	Sample Size
1	(Love et al., 2014)	To document and evaluate the production techniques, experiences, motivations, and demographics of aquaponics experts.	Experts or practitioners of aquaponics	US and internationally	809
2	(Murray and Watson, 2014)	To examine the biodiversity in hobbyist aquaria and those species available today from an aquaculture source in the context of a traffic light system to highlight gaps in aquaculture effort and identify groups that need fisheries assessments.	Hobbyist	Worldwide online survey	314
3	(Love et al., 2015)	To document the production techniques and profitability of commercial aquaponics.	Production workers	US and internationally	257
4	(Seixas et al., 2015)	To obtain a picture of the status of educational means utilized in teaching and learning in aquaculture, fisheries and aquatic resources management at the European level, particularly on information and communication technologies (ICT) and e-learning tools.	Teachers and students	Europe	484
5	(Villarroel et al., 2016)	To obtain a better idea about research and production focusing on five areas of aquaponic.	University Workers and commercial producers	Europe	68

6	(Jaric et al., 2018)	To gain in-depth insight into views on various topics linked to sturgeon life history, management and conservation, and views on issues described by a shortage of data.	Scientists / Researchers	Worldwide online survey	277
7	(Elfitasari et al., 2018)	To identify the effect of an aquaculture community group in social media Facebook on the development of aquaculture knowledge and financial health.	Farmers	Indonesia	200
8	(Kochalski et al., 2019)	To understand the general public's views of river fish biodiversity.	General population	France. Germany, Norway, and Sweden.	1000
9	(Marques et al., 2019)	To detect occupational hazards, risk assessment procedures, and prevention measures taken in Brazilian aquaculture	Aquaculture stakeholders (students, workers, researchers and farmers)	Brazil	108
10	(Marshall et al., 2019)	To study the view of live prey feeding to aquatic animals and to find out how this differs with taxonomic level of the prey and predator and if feeding was carried out on or off show.	Zoo and aquarium professionals	US and UK	248
11	(Van Osch et al., 2019)	To assess how the public makes decisions on what type of salmon or sea bream to buy based on the product's attributes.	Fish consumers	Ireland, the United Kingdom (UK), Italy, Israel and Norway	2520
12	(Yi, 2019a)	To investigate consumers' decision-making process for purchasing certified aquaculture products.	Fish Consumers	South Korea	960
13	(Yi, 2019b)	To examine how consumers' psychological and socio-economic characteristics influence their willingness to pay for sustainable agricultural -aquaculture products[1].	Fish Consumers	South Korea	525
14	(Ali et al., 2020)	To understand the risk factors of fish farms that have faced unusual tilapia mortality during the summer season.	Tilapia farms	Egypt	113
15	(Marvin et al., 2020)	To identify major drivers of change, indicators and data sourced connected to the two most significant vulnerabilities per supply chain step.	Experts	Norway	178
16	(Rickard et al., 2020)	To explore the influences leading individuals to perceive aquaculture as "factory-made" or "farm fresh".	Individuals[2]	US	800
17	(Zander and Feucht, 2020)	To contribute to the discussion on how to increase demand for carp by testing the acceptance of selected pre-processed carp products.	Fish consumers	Germany and Poland	999
18	(Ferse et al., 2021)	To combine non-published data on coral transplantation projects and obtain an overview of the broad features of these projects.	Coral transplantation organizations	Online	50
19	(Azra et al., 2021)	To understand how the pandemic affects aquaculture sectors both at a local and national level.	Aquaculture farmers	Malaysia	105
20	(Loncaric et al., 2021)	To measure consumer intentions in the consumption of farmed fish.	Fish Consumers	Coastal and continental Croatia	118
21	(Senten et al., 2021)	To report the effects of the global COVID-19 pandemic experienced by aquaculture producers.	Aquaculture farms and businesses	US	537

Note:

[1]Agriculture–aquaculture is a production method in which agriculture and fish farming are conducted simultaneously.

[2] Although 'Individuals' were listed as respondents for this research, the indicated unit of analysis was consumers.

Table 2: Publications of online aquaculture consumer studies in Scopus and Web of Science (2014- July 2021).

No.	Year	References	Studied topic
1	2019	(Yi, 2019a)	Consumer relationships: attitude, social norm, perceived behavioural control, and behavioural intention.
2		(Yi, 2019b)	Consumers' willingness to pay.
3		(Van Osch et al., 2019)	Consumers' preferences and willingness to pay
4	2020	(Rickard et al., 2020)	Consumer perception
5		(Zander and Feucht, 2020)	Consumer demand
6	2021	(Loncaric et al., 2021)	Consumer consumption intention and relationships between attitudes, subjective norms, perceived behavioural control

exempt. For example, survey research methodology is very prevalent in marketing research and is used extensively in various fields of marketing (Hulland, et al., 2018). Although consumer related online surveys are less common in aquaculture, our findings indicate that online survey research continues to play a significant role in academic research. Below, we report the findings from our review of online survey consumer research in aquaculture. The specific issues investigated are grouped into two broad categories: (i) the application of online surveys as the methodological approach in aquaculture consumer research and examine whether and to what extent the subject's research questions were answered and (ii) the strengths and weaknesses encountered utilizing online survey as a research methodology in aquaculture consumer studies.

Methodological Review and Examination to What Extent the Research Questions were Answered

As stated, a research strategy is reliant on several factors, including resources, time and current knowledge. The selection of a research strategy is also driven by the specified research question and aims (Yin, 2009). Each consumer behaviour research project design should include research objectives, design, sampling plan, data collection and analysis, and reporting (Chrysochou, 2017). In relation to the research purpose, quantitative methods objective is to test hypotheses, create predictions and simplify findings of the study population, whereas qualitative methods seek to primarily explore and acquire a deeper understanding of the phenomenon being examined (Chrysochou, 2017). Thus, some research strategies are more suitable than others (Yin, 2009).

In general, a survey research methodology responds to research questions such as who, what, where, how many and how much. While, consumer behaviour research focuses on what consumers buy, why, where and when, how and how often they buy it. Furthermore, consumer behaviour research is involved with how consumers utilize the product as well as how they discard it (Furaiji and Latuszyńska, 2012) (Yin, 2009).

Based on our findings from 2014 to 2019, each research project applying a standard online survey methodology of consumer behaviour in aquaculture followed the general steps of research objectives, research design, sampling, data collection and data analysis and reporting. Furthermore, the subject's research questions and objectives from the studies presented were satisfied through the employment of this methodology. The primary type of research questions or aims of the studies' publications seek mainly to answer the questions of 'how' in the investigation of specific behaviour, relationship, opinion or determinant regarding aquaculture products using various constructs. Descriptive statistics were used to describe the sample, while the research constructs were measured using scales. Therefore, the studies were generally exploratory in nature since the subject matter investigated was still comparatively new and unexplored.

Overall, the questionnaires were structured and sectionized into various components to include questions related to each study's specific research aims and purpose and the sociodemographic of the study population for measurement. In our review of publications, it was observed that 50% reported some level of pre-test or pilot activity. Likewise, the studies primarily used random and stratified sampling, as shown in Figure 6, and based on the information presented in Table 1, the sample sizes of consumers varied per study:118 (Loncaric, et al., 2021), 800 (Rickard, et al., 2020), 2520 (Van Osch, et al., 2019), 960 (Yi, 2019b) and 999 (Zander and Feucht, 2020). Generally, the selected sampling method is dependent upon the population of interest. However, an online survey sample may present challenges regarding the representativeness of a general population since some demographic groups online are strongly overrepresented while others are underrepresented in a sample drawn only online (Acharya, et al., 2013) (Andrews, et al., 2003).

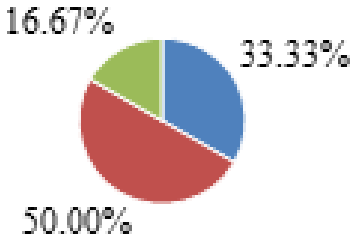

Figure 6: Sampling methods applied in online aquaculture consumer studies (2014-July 2021). **Note:** (▬) Random Sampling, (▬) Stratified Sampling, (▬) Purposive quota Sampling.

In the analysis of relationship testing, the two predominantly used models as supported measurements were coefficients and regression analysis of which reliability and validity were tested for each construct of measurements (Loncaric, et al., 2021) (Rickard, et al., 2020) (Van Osch, et al., 2019; Yi, 2019a) (Zander and Feucht, 2020). It is important to realize that survey methodology does not require control of behavioural events and focuses on contemporary events. Howev-er, according to Chrysochou, in consumer behaviour research, survey research is not always suitable to ex-plore behaviour, but it is more suitable to collect opin-ions (Chrysochou, 2017).

In consumer behaviour research, the primary research method chosen depends on whether the study seeks to measure behaviour or explore opinions, namely attitudes, perceptions, beliefs, etc. If the research seeks to measure opinions and the objective is to obtain a profound understanding of the phenomenon, methods like focus groups and in-depth interviews are more useful. However, if the objective is rather to obtain an overview and not explore the phenomenon in-depth, in this instance, survey methods are most preferred (Chrysochou, 2017).

Online Survey Strengths

The internet can facilitate researchers to access various markets and audiences that may otherwise be difficult to access via traditional research (Wilson and Laskey, 2003). Based on the online surveys conduct-ed in aquaculture consumer research, the researchers were able to increase the geographical spread of con-sumer respondents by countries and regions, thereby enabling the acquisition of information from a large sample of the population being studied. Particularly, the aquaculture research conducted by (Van Osch, et al., 2019) acquired purchasing decision information from a large consumer sample of 2520 respondents in five countries: Ireland, the UK, Italy, Israel and Nor-way. Another major advantage drawn from this review is centred on the formation of the questionnaires as the instrument used for data collection, which included the divisions of sections or parts to measure demographic information of the studied sample (Rickard, et al., 2020) (Van Osch et al., 2019) (Yi, 2019a, 2019b). As a result, the online consumer surveys were suitable for collecting demographic data that portrays the composition of the sample and consequently creating consumer profiles.

According to Chrysochou and Glasow, this type of methodology is more suitable for generalizing the studied phenomenon. In this case, the online surveys shown in this review permitted the researchers the capability to attain generalizations about the consumer population regarding various subject matters, namely: consumer perception, preferences, willingness to pay, behaviour, attitudes and relationships to aquaculture products (Loncaric, et al., 2021) (Rickard, et al., 2020) (Van Osch, et al., 2019) (Yi, 2019a, 2019b) (Zander and Feucht, 2020).

Other known strengths that online consumer surveys and online surveys in general facilitate includes lesser time and lower cost required for administration as well as ease and control in conducting research in the real world (Chrysochou, 2017) (Friedrich et al., 2009, 2009) (Nayak and Narayan, 2019). However, although highly feasible, these particular strengths were not indicated in the aquaculture consumer research publications retrieved in 2014-2021. Table 3 summarizes the strengths and weaknesses encountered in online consumer studies in aquaculture.

Table 3: Outline of the strengths and weaknesses of online consumer aquaculture studies.

Strengths	Weaknesses
Increase geographical reach and market access of consumers	Improper measurements can alter consumer perception
Collect information from a large consumer sample of the population	Actual “real-time” product visuals, including product tasting are not viable.
Collect demographic data and create consumer profiles that describe the composition of the sample.	The research is conducted in an online setting instead of an environment where the product being studied resides. Consumers are then required to envision the environment where the product is being sold.
Make generalizations about the phenomenon being studied.	Poor recall of species and behaviour.
	Inadequate formulation of the research instrument and failing to distinguish between various types of aquaculture on the questionnaire can hinder consumer perception and reduce reliability.
	Inability to access knowledgeable and appropriate consumers who are computer literate and have internet access
	Missing data and low response rates

Online Survey Weaknesses

While online surveys make a valuable contribution to our understanding of consumer behaviour, there are several vulnerabilities that can hinder the potential value of this survey methodology in aquaculture consumer research. We identify significant weaknesses that aquaculture researchers encountered in their online consumer research. First, one of the significant limitations experienced by Rickard, derived from measurement. As the term 'aquaculture' is broad, using this instrument without differentiating between various types of aquaculture can lead to altered consumer perceptions.

Furthermore, supermarkets and fish markets are highly influential players in the global distribution and sales of aquaculture products (FAO, 2018). Henceforth, another major limitation of this instrumentation relates to the population targeted since the significant gathering of this population is generally situated in supermarkets or fish markets. Consequently, when responding to several online aquaculture surveys, consumers were asked to either imagine the specific species being studied or envision themselves shopping in the seafood section of a supermarket (Rickard, et al., 2020) (Van Osch, et al., 2019).

When responding to surveys, respondents may have difficulty with recall (Glasow, 2005). The lack of species recall was observed as a drawback in aquaculture studies. Therefore, to reduce this possibility in the examination of consumer preferences, in the questionnaire instrument, researchers displayed pictures of the product being studied next to the questions being asked (Zander and Feucht, 2020). As per the authors, product tasting was also not possible through this type of research. Several respondents had difficulty evaluating their own behaviour, thus resulting in the high proportion of "unsure/I do not know" responses (Rickard et al., 2020).

A main drawback of the online survey method is the inability to access knowledgeable participants who are computer literate and have internet access (Nayak and Narayan, 2019). This disadvantage was presented in the aquaculture consumer studies, thereby reducing the number of consumers able to participate. Hence, to increase population representativeness due to this obstacle, researchers supplied internet access to the targeted respondents who were without (Rickard, et al., 2020). Another limitation that aquaculture consumer researchers encountered with the employment of this methodology was missing data whereby respondents skipped a proportion of questions. Thus, resulting in the exclusion of these questionnaires and ultimately reducing the sample (Rickard, et al., 2020).

In general, low or poor response rates were prevalent in the consumer studies conducted during this period and occurred because respondents refuse to participate and or the initial participants did not satisfy the criteria for the research. For example, in the study of (Yi, 2019a) a total of 2,302 prospective respondents were first invited to respond to the survey. However, due to lack of participation, the final response rate dropped to 22.8%, a total of 525 responses. From another study, 2,700 survey subjects were supplied; however, only those willing to pay for sustainable aquaculture products were included in the final sample of 960(Yi, 2019b).

Online surveys restrict the researcher to probe the participant to get answers or ask leading questions(Nayak and Narayan, 2019). Aquaculture researchers found that the reliance on one question (single item measure) in assessing respondents' risk and benefits, mainly when consumers lack adequate information about the subject area, may reduce reliability (Rickard, et al., 2020).

Based on these disadvantages and analysis of the aquaculture consumer publications presented in this review, this article further suggests several implications for researchers, scholars, practitioners and well as managers to better understand the application of online surveys in aquaculture consumer research.

CONCLUSION

The review synthesizes and organizes the main methodological findings of online studies in aquaculture focused on consumer studies. In recent years, consumer studies applying online surveys as a methodological approach in aquaculture research has evolved but is still underutilized. Despite its novelty, similar to other research methodology, online surveys have distinct strengths and weaknesses specific to consumer aquaculture research. The results of this article provide aquaculture researchers with a perspective on the possible strengths and weaknesses of this methodology and offer practical recommendations on how to improve online consumer survey practices in aquaculture.

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LIMITATIONS AND OPPORTUNITIES FOR FUTURE RESEARCH

Though the analysis carried out in this review provides valuable information to aquaculture researchers and practitioners, several constraints of the review should be indicated. The primary limitation of this review is due to the novelty of this methodology in the field of aquaculture, resulting in a small body of online con-

sumer research. Hence, the publications retrieved for analysis were limited and lacked extensive evidence for this review. Consequently, it was challenging to make generalizations and realize essential relationships from the findings. In this regard, future research with a prolonged study period would strengthen the findings and generalizations of this review.

Furthermore, as this article reviewed focus on online consumer aquaculture studies, future research can investigate and categorize the results of online surveys in the other disciplines in aquaculture, including the impact and implications of online surveys in each discipline. Finally, a greater scientometric analysis is recommended for future studies to measure and analyse scholarly literature and the production of scientific publications using online surveys in aquaculture consumer research.

RECOMMENDATIONS AND IMPLICATIONS

The review is aimed to provide a guideline for scholars in developing their future research efforts. In this regard, this review presents some implications for improving online survey practices applicable to further developments for aquaculture consumer research.

Firstly, although the research question should establish the object of measurement or unit of analysis in consumers surveys, consumer researchers generally pay little attention to selecting the most suitable survey participants, typically assuming that everyone is a consumer. Moreover, generally in academic marketing studies, the target population to which the scholar intends to generalize the research findings is usually unclear. However, in consumer re-search, choosing the most suitable respondents for the research is essential. Therefore, our findings highlight that scholars should clearly de-fine and justify the object of measurement as consum-ers even when the unit of analysis is individuals and select the most suitable respondents for the research.

In one of the studies from this review, based on specific inclusion criteria, the researchers provided filter questions at the beginning of the questionnaire to better target the population to be studied. Nonetheless, by clearly identifying the re-search's unit of analysis and selecting the appropriate respondents, the weaknesses described in this review can be reduced. Firstly, the researchers may be able to improve the low response rate problems such as inability to reach the potential respondents (i.e., fish consumer) who are willing to participate and who meet the research criteria, as well as respondents who can participate based on the choice of data collection (i.e., internet access and internet literacy, etc.).

The online consumer studies in this review applied various sampling procedures. Researchers conducting online aquaculture consumer studies are encouraged to implement systematic sampling procedures in their methodology, ideally probability sampling methods, such as random or stratified sampling, and avoid relying on non-probability sampling methods such as convenience/purposive sampling and quota sampling. If non-probability sampling is used, prudence must be exercised in interpreting the research results. Notably, the correct sampling procedures can improve response rates and representativeness of the sample and consequently help make better generalizations of findings from a sample to a population.

Pre-test or pilot studies are another way to improve the survey's response rates. Pre-tests or pilot studies pro-vide preliminary feedback regarding the quality of the survey design and are important in increasing the com-prehension and accuracy of the questions. Fifty per cent of the studies in this re-view have implemented either a pre-test or pilot study. Therefore, we recommend that all scholars should implement pre-tests preceding their primary surveys.

According to the results, it is encouraged for research using this methodological approach to revise their questionnaire strategies based on the reliability of response scales for measurement, whether the application of single-item or multiple item measures will be appropriate for the research. Based on our findings, researchers should clearly distinguish and describe the specific aquaculture types presented in the study based on species, production, and location in the formulation of the questionnaire.

In general, the nature of the study determines the research methodology. As previously mentioned, survey methods are most preferred in obtaining a general overview of a phenomenon, whereas focus groups and in-depth interviews are best if the study's objective is to gain a deep understanding of a phenomenon. In other words, surveys may not be sufficient to respond to the questions that the researcher is seeking to answer in the study. Therefore, more in-depth interviews or focus groups may be needed. Rickard, et al., 2020 con-firmed this principle in examining factors influencing in-dividuals who view aquaculture as a factory or farmed made; the researchers recommended touse qualitative research such as focus groups or in-depth interviews with stakeholders for future research to obtain a more in-depth understanding of the problem.

Furthermore, scholars must evaluate their research objectives and the consumer information needed to answer the reach questions and assess whether online surveys are the best methodological approach. For example, if the consumer information required for the study entails incorporating product tasting, then online surveys are not the best data collection method to be used.

Together with several other online survey method-ological references, these suggestions will hopefully improve the application and promote the best prac-tice and techniques of online surveys in aquaculture consumer research. Although the review realized the research's main aim and answered the research ques-tions, several limitations are included in this review.

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