Attitudes towards and intentional reactions to mariculture development –
A local resident's perspective

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Abstract

The value of mariculture has been the subject of extensive research from the policy, economic, environmental, food security and nutritional perspectives. However, limited research has addressed social aspects, such as the perceptions of the local population living next to or in close proximity to mariculture (marine food production) locations. Therefore, this study surveys local residents' perceptions of interactions between mariculture development and environmental and economic consequences. This study then analyses the extent to which the perceived consequences of mariculture, as well as the attitudes towards tourism, affect residents' general attitudes towards mariculture. Third, the study analyses the attitudes' effect on the intentional resistance of local residents to a further development of mariculture within their region. The analyses show a significant effect of perceived economic and environmental consequences on general attitudes towards mariculture development. This study does not support previous conceptions proposing attitudinal connections between tourism and general attitudes towards aquaculture. General attitudes towards mariculture are a good predictor of intentional resistance to mariculture development. Theoretical and policy implications are outlined and discussed.

1. Introduction

Aquaculture (i.e., farming of aquatic organisms, including fish, molluscs, crustaceans, and aquatic plants) is playing an increasingly important role in the global food supply. The contribution of aquaculture to total fish production has risen steadily, reaching 44 % in 2014 (Moffitt & Cajas-Cano, 2014). The future growth of aquaculture is expected to help accomplish the Sustainable Development Goals (SDGs) by reducing environmental consequences associated with livestock while simultaneously increasing food security and promoting the nutritional benefits of marine food products (Thilsted et al., 2016). An increase in aquaculture is, however, dependent on its expansion to new sites outside the traditional aquaculture areas. Sweden, especially its southwest region, is one potential new area for mariculture development. The Swedish government has adopted a national strategy to develop the mariculture industry to enable it to become a profitable and sustainable industry with ethical production standards[1]. While producing moderate quantities today, the year-on-year growth target for Swedish aquaculture between the present and 2020 is an average increase of 8% annually (corresponding to a 71% increase from 2013 to 2020). This ambition corresponds to an annual production of fish for consumption and of crayfish and mussels of approximately 23,000 tonnes as well as a total annual production of 25,000 tonnes of fish and crustaceans in 2020[2].

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[1] Jordbruksverket 2012: Svenskt vattenbruk – en grönnäring på blå åkrar. Strategi 2012–2020.
[2] Jordbruksverket 2015 (N2015/2183/FJR): Flerårig nationell strategisk plan för vattenbruket i Sverige 2014–2020.

While the biological and geographical conditions in the area seem promising, Bailey, Jentoft, and Sinclair (1996) showed that mariculture development is not just influenced by natural and physical conditions but by conditions that are inherently economic and social in nature. Research has proven that there may be positive effects (Ceballos, Dresdner-Cid, & Quiroga-Suazo, 2018; Toufique & Belton, 2014) or no impact (Nguyen, Jolly, Bui, & Le, 2016) on the economy. Little research has, however, been conducted to understand the perceived contribution in social and economic terms. The increasing importance of mariculture as an industry and its development in coastal areas outside traditional mariculture areas (Oyinlola, Reygondeau, Wabnitz, Troell, & Cheung, 2018) has prompted a need to integrate an understanding of the social and economic conditions as a prerequisite for sustainable development (Barrington, Ridler, Chopin, Robinson, & Robinson, 2010; Bucklin & Howell, 1998). Consideration of the local population within communities is a fundamental precept of new mariculture development to understand the views and perspectives of the local residents and ensure local acceptance (Memery & Birch, 2016; Salgado, Bailey, Tiller, & Ellis, 2015). Despite the increased attention paid to mariculture development, research on social conditions is limited (Mazur & Curtis, 2008; Nash, 2004) and no studies have included local residents' perspectives on social and economic conditions. Expansion of mariculture of most species requires access and use of coastal areas. This is also anticipated for mariculture development in the archipelago in the southwest of Sweden, a coastal region suitable for mariculture development. Because the development initiatives may potentially affect archipelago communities, local residents and second-home owners, who have invested in their properties and the proximity to the sea as valuable assets, will be affected. Their attitudes and reaction towards mariculture will therefore be of importance in the future development. However, researchers are still struggling to answer the most basic question: How will local residents react to new mariculture development in their region? The aim of the present study is to

investigate the attitudes and resistance intention of residents in southwest Sweden regarding the development of new mariculture. Understanding the perceived social consequences will assist policy makers, mariculturists, mariculture advocates and other professionals seeking to further develop a sustainable mariculture industry.

2. Previous research

A few studies have explored attitudes towards mariculture development. Memery and Birch (2016) used a qualitative consultative stakeholder approach to explore attitudes towards mariculture development in southwest England. Chu, Anderson, Asche, and Tudur (2010) compared the attitudes of aquaculture stakeholders in the U.S. and Norway, and Mazur, Aslin & Byron (2006) surveyed households and interviewed key stakeholders in an attempt to reveal differences in perceived aquaculture risks in Australia. Whitmarsh and Wattage (2006) surveyed Scottish households´ attitudes towards salmon farming. Fernández-Polanco and Luna (2012) surveyed Spanish consumers' attitudes towards aquaculture as a method for food production. Robertson, Carlsen, and Bright (2002) investigated the influence of information on attitudes towards marine aquaculture among visitors to a seafood festival in coastal New Hampshire. Freeman et al. (2012) compared the public´s attitude towards marine aquaculture in Germany and Israel.

The existing literature is, however, characterized by ungainly efforts and an intermittent compilation of answers. One explanation for this lack of clear findings might be the uninformed choice of study objects. It appears as if most studies have investigated the attitudes of the public (e.g., Freeman et al., 2012), the consumers (e.g., Fernández-Polanco & Luna, 2012; Whitmarsh & Wattage, 2006) or convenience-sampled respondents (e.g., festival visitors in the study by Robertson et al. (2002)). Three exemptions are: Memery and Birch (2016), who identified important stakeholder sectors (e.g., fishing/marine, tourism, and

environmental sectors) and explored their mixed attitudes; Chu et al. (2010), who surveyed attitudinal differences among aquaculture stakeholders (e.g., aquaculturists, researchers, fishermen, NGOs, professionals, and governmental officials) in the U.S. and Norway; and Mazur et al. (2006), who included key stakeholders (i.e., community groups, tourism, researchers, and state and local government staff) in addition to surveying the public. Thus, local resident´s attitudes towards mariculture have not been investigated in previous studies.

Another possible reason is the lack of theories and conceptual frameworks guiding previous research. Ajzen and Fishbein (1980) stated that attitudes are strongly related to how people will behave. Therefore, in our study, we draw from the underpinning principles of the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 2011) to understand how attitudes can explain individuals' behavioural intentions.

Our research responds to the call for more research by Kim, Duffy, Jodice, and Norman (2017) "to further explore the relationship between aquaculture and tourism, particularly with regard to public perceptions of aquaculture" (p. 311). This study contributes to the existing literature in four important ways. First, it addresses the calls for research on the social factors that influence mariculture developments (e.g. Kim et al., 2017; Robertson et al., 2002). Second, we build upon previous research (i.e. Ajzen & Fishbein, 1980; Fishbein & Ajzen, 2011) to develop a better understanding of the social conditions influencing mariculture development. Third, given the diversity of the social environments surrounding mariculture development, our study focuses on an often forgotten group, namely, the residents in the region who have to live with the long-term consequences of mariculture development. Fourth, most previous studies have investigated attitudes towards mariculture development but neglected the attitude-behavioural intent relationship in mariculture development. Only the study conducted by Chu et al. (2010) was designed to understand the role of attitudes and perceptions in determining behavioural choices (i.e., actively supporting aquaculture

expansion in their country over the next three years – no, yes, uncertain). Our study goes one important step further in identifying and conceptualizing potential future intended actions based on the local resident's attitudes. This link between attitudes and intentional behaviour has not been studied in previous research.

3. Conceptual framework

The Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980) is proposed to study social conditions influencing mariculture development. Within this framework, attitude towards behaviour (e.g., mariculture and tourism) refers to the degree to which a person has an unfavourable/favourable evaluation of the behaviour. Attitude is assumed to influence behavioural intention significantly because human behaviours are under volitional control. Intention is defined as the person´s estimate of the likelihood that they will perform the behaviour. The motivational factors that influence behaviour are assumed to be captured by the intention (Eagly & Chaiken, 1993). TRA uses attitudes and norms to predict behavioural intent. We chose not to include norms (i.e., the expectations of others) in our framework out of the conviction that attitudes towards mariculture development are more strongly associated with behavioural intent than norms in this special context.

In the research model described below, the drivers of the residents´ resistance intentions are outlined. In line with the TRA (Fishbein & Ajzen, 1975), individual traits seldom affect behaviour directly but do so through more behaviour-specific attitudes. Thus, we include *attitude towards mariculture* as an intermediate factor in the model. The model characterizes a mariculture development scenario involving local residents who may react to mariculture development plans. Next, each of the constructs will be discussed in turn, and the proposed relationships will then be formally stated as hypotheses for empirical testing.

3.1 Attitude towards mariculture and resistance intention

Mariculture development may threaten residents´ perceived freedom if the development is perceived as negative. Psychological reactance theory (Brehm & Brehm, 2013; Zhang & Sapp, 2013) posits that individuals will be motivated to re-establish that threatened freedom through engaging in resistance acts. Individuals' positive attitudes towards mariculture will therefore result in stronger resistance intentions, while positive attitudes result in lower resistance intentions. Resistance, in our context, refers to residents' intended opposition to mariculture development attempts (Burroughs, 2007).

The attitudes that may affect mariculture attitudes are determined by the costs and benefits perceived by the residents. Both Memery and Birch (2016) and Freeman et al. (2012) illustrated that mariculture is a multi-faceted industry and that its development in new regions is perceived to have at least two, but perhaps multiple, consequences related to economic development and environmental consequences. We therefore extend the original TRA by including these expected consequences in our framework and posit that attitudes towards mariculture in general are determined by two constructs: (1) economic benefits and gains and (2) environmental consequences. Therefore, we propose the following hypotheses:

H1: Residents' positive perceptions of the economic impacts of mariculture development have a positive impact on their overall attitudes towards mariculture development.

H2: Residents' negative perceptions of the environmental consequences of mariculture development have a negative impact on their overall attitudes towards mariculture development.

H3: Residents' positive overall attitudes towards mariculture development result in less resistance intention towards mariculture.

3.2 Attitude towards tourism

Previous studies have linked attitudes towards tourism and attitudes towards mariculture. Freeman et al. (2012) found that residents experiencing benefits and gains from the tourism industry may be less likely to support mariculture development, and they will develop negative attitudes towards mariculture due to the conflicting interests associated with the use of resources, specifically, water and the coast (Freeman et al., 2012). Hofherr, Natale, and Trujillo (2015) found that the relationship between attitudes towards tourism and attitudes towards mariculture is dependent primarily on the location of mariculture production. They state "that there is evidence of strong negative spatial interaction up to a distance of 3 km" (p. 27) between mariculture sites and hotels. Memery and Birch (2016) support that conflicts may arise when co-locating tourism infrastructure such as hotels with mariculture production because the natural beauty of the destination is one important motivational aspect, which may be deteriorated by mariculture production. This is a likely scenario in the southwest-Swedish archipelago where the beauty of the area is one important reason for visitation. Residents' positive attitudes towards tourism as job generator and a way to provide leisure opportunities, may thus affect their attitude towards mariculture development negatively if seen as having conflicting uses of coastal areas (Nimmo & Cappell, 2009; Tiller et al., 2014). However if seen as a complementary industry providing a better and safer supply of local food products there may be a positive relationship between these sets of attitudes. Results from a study by Memery and Birch (2016) suggest that those working in the tourism/leisure sector had mixed perceptions (ranging from neutral to negative) on mariculture development. Lee, Packer, and Scott (2015) support a positive relationship between mariculture development and tourism attitudes by stating that tourism demand is partly driven by lifestyle preferences such as food experiences. The importance of food and culinary preferences in terms of travel motivation is also supported by McKercher, Okumus, and Okumus (2008). An improvement in the supply

of locally produced food is therefore likely to be regarded as an asset by tourists and the

tourism industry (Deale, Norman, & Jodice, 2008; Higgins-Desbiolles, Moskwa, & Gifford,

2014; Peštek & Činjarević, 2014), but also by the local population consuming and benefiting

from high quality food products in their everyday consumption. A better and safer supply of

marine food products may therefore be perceived as strengthening the competitive advantage

of a destination. Based on the discussion above, we hypothesize the following:

H4: Residents' positive attitudes towards tourism has a positive effect on their overall
attitude towards mariculture development.

Figure 1 summarizes the hypotheses and provides an overview of the research model.

The arrows depict the relationships between the constructs subject to statistical testing.
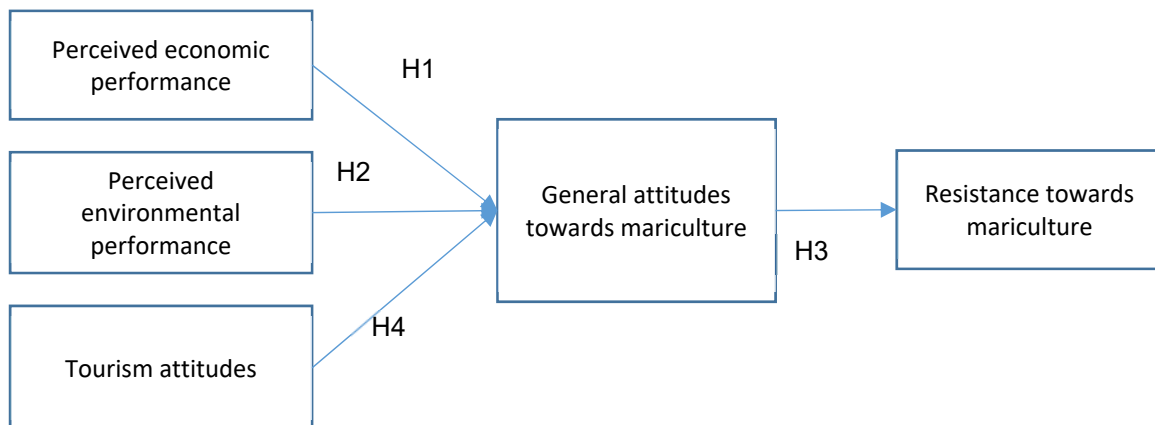
Figure 1: Research model

4. Research method

To test the proposed hypotheses, data collection was conducted on the west

coast of Sweden in three rural municipalities in the West Sweden archipelago that are strongly

rooted in the wild-caught fish industry. During the last century, these communities have

moved from fishing to tourism-oriented production. At present, mariculture is a

complementary strategy used for economic development to 1) cater to local food experiences; 2) even out strong seasonality (high season in June, July and August) in the tourism industry; and 3) develop new employment opportunities.

4.1 Sampling procedure

To understand the social and economic views and perspectives of mariculture development, the population primarily affected by mariculture development was studied. Two distinct interest groups are studied in each of the three municipalities: those living permanently in the municipality and those owning a second home. Members of the latter group usually live in their second homes for a limited number of weeks each year but have significant social and economic interests in regards to their property as well as the community.

Local residents were randomly sampled from lists of people living in one of the three municipalities, yielding three samples. The lists of local residents were retrieved from Statistics Sweden, the national bureau of statistics. These lists did not include second homeowners, which instead were randomly sampled from the cadastre retrieved from the Swedish Real Property Register. A random sample was drawn from the cadastre to represent second homeowners in each of the three municipalities (three samples in total). To be included in a sample of second home owners, individuals had to own a property in one of the municipalities and have their primary place of residence in a different municipality. The data were collected by means of telephone interviews conducted by a professional data collection agency (Kantar TNS Group) during three weeks in the fall of 2017.

In total, 1.656 individuals were invited to participate in the survey. Of these, 996 did not answer. Some refused to take part in the survey (817 persons), and some were travelling during the period of the data collection (46 persons). Additionally, 133 persons

were not reached during the period of the data collection despite six attempts by the data collection agency.

A total of 660 respondents responded to the survey, and the response rate was 40%. The mean age of the sample is higher (second home owners: 64.5 years; local residents: 59.9 years) than the official statistics (Lysekil: 46.6 years; Orust: 46.9 years and Sotenäs: 49.1 years), and the gender distribution is relatively even, both for second home owners and for local residents.

4.2 Measures

The respondents were asked a set of questions relating to their attitudes of specific and general mariculture aspects, their resistance towards mariculture and their attitudes towards tourism. Items relating to tourism attitudes were adapted from Freeman et al. (2012). The respondents were asked to state their degree of agreement using a scale of 1 (= strongly disagree) to 5 (= strongly agree). The items included were "I support tourism as having a vital role in this community" (TA1), "Tourism holds great promise for my community's future" (TA2), and "The overall benefits of tourism outweigh its disadvantages" (TA3).

The questions relating to attitudes towards mariculture are based on Freeman et al. (2012) and D'Anna and Murray (2015). The respondents stated their level of agreement (between 1 and 5) with the following dimensions: 1) *economic performance*: "Mariculture provides sustainable jobs" (EP1), "Mariculture is a good alternative to wild catch fishing" (EP2), and "Mariculture produces healthy fish" (EP3); 2); *environmental concerns*: "Mariculture has contributed to the pollution in our seas and bays" (EC1), "I am concerned that mariculture causes pollution and changes on the ocean bottom" (EC2), and "Seeing debris from mariculture farms washed up on the shoreline diminishes my opinion of the

industry" (EC3); and 3) *general attitudes towards mariculture*: "Developing mariculture in my municipality is a good idea" (GA1), "Mariculture's benefits outweigh its disadvantages" (GA2), and "People living in this municipality should recognize mariculture as part of living on the coast" (GA3).

Items that measure individuals' resistance towards mariculture were retrieved from organizational behaviour studies published by Helpap (2015) and Oreg (2003, 2006) and adapted to our study to cover the intentional behavioural aspects of resistance to change.

Resistance towards mariculture development is conceptualized as the individual's planned choice to carry out a particular behaviour in the future (Conner et al., 1999; Malle and Knobe, 1997). This construct is typically measured as "I am planning to…." or "I intend to….". The items are measured on a 5-point Likert-type scale. These were "I plan to look for ways to prevent the change from taking place" (IR1), "I plan to protest against the change" (IR2), "I plan to present my objections regarding the change to management" (IR3) and "I plan to complain about the change" (IR4).

4.3 Data analysis methods

The measurement model was examined using IBM SPSS Statistics 25 and IBM SPSS Amos 25 Graphics. Confirmatory factor analysis was performed to confirm the factors and measurement items (Tabachnick & Fidell, 2006). In accordance with the recommendation of Jaccard, Jaccard, and Wan (1996), the chi-square statistic (χ^2), the normed chi-square (χ^2/df), the standardized root mean squared residual (SRMR), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), the incremental fit index (IFI), and the Tucker-Lewis index (TLI) were used to assess the model's fit. The reliability of each factor was analysed using Cronbach's alpha and composite reliability. The convergent validity

of each factor was assessed, and discriminant validity was tested to examine whether the

constructs measured distinct phenomena (Kline, 2005).

5. Analysis

5.1 Descriptive analysis

The descriptive statistics are provided in Table 1. The mean scores for the items

measuring tourism attitudes vary between 4.19 and 4.44, revealing relatively stable and

positive attitudes towards tourism. The fairly small standard deviations (0.80-0.89) indicate a

consistency in how respondents answered, indicating good knowledge of and experience with

the industry.

The mean scores concerning the environmental consequences of mariculture

range from 3.03 to 3.55, with considerably higher variance among respondents (SD 1.07-

1.25), which may be an indication of more uncertainty and less informed responses. With

regard to the perceived economic consequences of mariculture responses (mean 3.24-3.54, SD

1.00-1.13), the results suggest more consistent and slightly positive perceptions of the

industry.

Table 1: Descriptive survey statistics.

Code	Question	Mean	SD
TA1	I support tourism as having a vital role in this community	4.44	0.80
TA2	Tourism holds great promise for my community's future	4.24	0.89
TA3	The overall benefits of tourism outweigh its disadvantages	4.19	0.89
EC1	Mariculture has contributed to the pollution in our seas and bays	3.06	1.07
EC2	I am concerned that mariculture causes pollution and changes on the ocean bottom	3.03	1.18
EC3	Seeing debris from mariculture farms washed up on the shoreline diminishes my opinion of the industry	3.55	1.25
EP1	Mariculture provides sustainable jobs	3.53	1.00
EP2	Mariculture is a good alternative to wild catch fishing	3.27	1.13
EP3	Mariculture produces healthy fish	3.24	1.07
GA1	Developing mariculture in my municipality is a good idea	3.61	1.07
GA2	Mariculture benefits outweigh its disadvantages	3.43	1.05
GA3	People living in this municipality should recognize mariculture as part of living on the coast	3.63	1.08
IR1	I will look for ways to prevent the change from taking place	1.97	1.14
IR2	I will protest against the change	1.95	1.16
IR3	I will present my objections regarding the change to management	1.95	1.16
1R4	I will complain about the change	1.88	1.10

The average values for the overall attitudes towards mariculture (mean 3.43-3.63, SD 1.05-1.08) support a positive general perception of the industry. Accordingly, the mean scores regarding resistance behaviour are relatively low (1.88-1.97) on a scale from 1 to 5. The standard deviations for these items vary from 1.10-1.14.

5.2 Measurement model

To validate the constructs, the research model was assessed using confirmatory factor analysis (CFA), in which all measurement items were loaded on their expected constructs (Gerbing & Anderson, 1988). The results of the CFA using maximum likelihood estimation indicated that the overall fit of the measurement model was statistically adequate ($\chi2 = 138$, df = 93, p > .001, $\chi2/df = 1.489$, CFI = 0.989, IFI = 0.989, TLI = 0.986, and RMSEA = 0.027). All results indicate an acceptable model fit (Schumacker & Lomax, 2010).

Table 2: Summary of the results of the confirmatory factory analysis.

Construct	Code	Standardized Loading	Squared Multiple Correlation	Cronbach's Alpha	AVE[1]	CR[2]
Tourism attitudes:				0.82	0.61	0.82
	TA1	0.81	0.65			
	TA2	0.83	0.68			
	TA3	0.70	0.48			
Perceived environmental concerns:				0.68	0.40	0.67
	EC1	0.67	0.45			
	EC2	0.71	0.50			
	EC3	0.51	0.26			
Perceived economic performance:				0.70	0.41	0.67
	EP1	0.67	0.45			
	EP2	0.62	0.39			
	EP3	0.61	0.37			
General mariculture attitudes:						
	GA1	0.83	0.69	0.85	0.62	0.83
	GA2	0.76	0.57			
	GA3	0.77	0.59			
Resistance towards mariculture:				0.90	0.66	0.88
	IR1	0.81	0.66			
	IR2	0.83	0.69			
	IR3	0.80	0.64			
	IR4	0.79	0.63			

[1] Average variance extracted
[2] Composite reliability

The construct reliability for all measures was above the acceptable .6 level (Hair et al., 2010). The scale reliability for the exogenous constructs is as follows: tourism attitudes .82, perceived environmental performance .68 and perceived economic performance .70. Reliability for the endogenous constructs is as follows: The general attitudes towards mariculture - .85 and resistance towards mariculture - 90. Convergent validity is evaluated by examining the t-values of each item's factor loading on its underlying construct. The standardized factor loadings for all measurement items range from .51 to .83, and each t-value is statistically significant ($p < .001$). Convergent validity was established because all factor loadings exceeded .5 and were statistically significant ($t > 1.96$, $p < .05$) (Gerbing & Anderson, 1988). The AVE exceeds 0.5, except for perceived environmental and economic performance, where the AVE is between 0.4 and 0.5. Considering that AVE for the two constructs is above 0.4 and composite reliability (CR) is above 0.6, convergent validity is still established (Fornell & Larcker, 1981). Discriminant validity was estimated by comparing the AVEs with the squared correlations between constructs (Fornell & Larcker, 1981; Hair et al., 2010). For all independent constructs, the squared correlations between each pair of constructs were less than the AVEs.

5.3 Structural model

Based on the results of the CFA, a structural model (outlined conceptually in Figure 1) with five constructs was estimated to test the four hypotheses (Iacobucci, 2010). The structural equation modelling (SEM) approach was conducted using maximum likelihood (ML) estimation to evaluate the hypothesized relationships among the constructs (using SPSS Amos 25 Graphics). The goodness-of-fit statistics of the proposed model indicated that the model fits the data adequately ($\chi^2 = 199.5$, df = 97, $\chi^2/df = 2.06$, $p < .001$, CFI = .98, IFI = .98, TLI = .97, and RMSEA = .04).

The structural model was tested separately for second homeowners and local residents to determine if group differences exist. A Chi square difference test between the unconstrained model (χ^2 = 331.9, df = 194) and the constrained model (χ^2 = 346.4, df = 206) indicates no differences between the groups (p=0.49).

Table 3 summarizes the empirical findings from the structural model in terms of unstandardized and standardized coefficients, standard errors and significance levels. The R^2 values indicate the predictive power of the structural model at the end of Table 3.

Table 3: Unstandardized and unstandardized factor loadings, standard errors and significance levels for the structural model (N = 660).

			B	β	S.E.	ρ	
TA1	←	Tourism attitudes	1,05	0,81	0,06	***	
TA2	←	Tourism attitudes	1,19	0,83	0,07	***	
TA3	←	Tourism attitudes	1	0,69			
EC1	←	Environmental concerns	0,88	0,69	0,09	***	
EC2	←	Environmental concerns	1	0,68			
EC3	←	Environmental concerns	0,79	0,52	0,08	***	
EP1	←	Economic performance	0,97	0,67	0,07	***	
EP2	←	Economic performance	1	0,62			
EP3	←	Economic performance	0,91	0,61	0,07	***	
GA1	←	Mariculture attitudes	1,06	0,83	0,05	***	
GA2	←	Mariculture attitudes	0,94	0,76	0,05	***	
GA3	←	Mariculture attitudes	1	0,76			
IR1	←	Resistance mariculture	1	0,81			
IR2	←	Resistance mariculture	1,04	0,83	0,05	***	
IR3	←	Resistance mariculture	0,96	0,8	0,05	***	
IR4	←	Resistance mariculture	1,01	0,79	0,05	***	
Mariculture attitudes	←	Environmental concerns	-0,20	-0,19	0,05	***	
Mariculture attitudes	←	Economic performance	1,01	0,85	0,09	***	
Mariculture attitudes	←	Tourism attitudes	-0,03	-0,02	0,05	0,61	
Resistance mariculture	←	Mariculture attitudes	-0,51	-0,46	0,05	***	
R^2 General attitudes towards mariculture		0.86					
R^2 Resistance towards mariculture		0.21					

All items load significantly on their construct and all standardized path estimates, but one (tourism attitudes → mariculture attitudes) is significant. This means that environmental concerns and economic performance have a significant effect on attitudes towards aquaculture. The effect of economic concerns is 0.85 and -0.19 for environmental concerns.

Together, these two constructs explain 86 % of the variance in general attitudes towards mariculture which is far beyond expectations in terms of variance explained. Tourism attitudes have no effect on mariculture attitudes. The general attitudes towards mariculture explain 21 % of the variance in resistance towards mariculture.

The signs of the path estimates should be interpreted as if the more negative the environmental concerns are about mariculture development, the more negative are the general attitudes towards mariculture development. The more positive mariculture is perceived in terms of economic performance, the more positive are mariculture attitudes. Positive mariculture attitudes have a negative effect on resistance intentions.

6. Discussion and conclusions

The purpose of the present study was to investigate the attitudes and resistance intention of residents in southwest Sweden towards new mariculture development. TRA and TPB constitute a solid theoretical foundation for the study, suggesting future applicability in the context of mariculture development. The effect of economic and environmental consequences is significant and strong on general attitudes towards mariculture development. Those consequences explain 80% of the variance in general attitudes. General attitudes, in turn, are a good predictor of the stated resistance to mariculture development.

Mariculture, in this study, was introduced to respondents as a broad concept; this study did not specify the species that would be cultured, and no distinction was made between the different techniques. More research is needed concerning the types of techniques and species because different techniques have varying connectedness to society, provide differing opportunities to develop the local economy by means of providing local produce, provide different amounts of full-time jobs, and have specific environmental impacts. Legal frameworks often limit the possible versions of mariculture solutions due to regulations. Having legal frameworks in place that prevent negative environmental impacts does,

however, not necessarily mean that society believes that mariculture does not impinge on the environment.

From a societal perspective, mariculture development implies an environment-economy trade-off (Whitmarsh & Palmieri, 2011). Although mariculture a sustainable and effective alternative to other livestock farming with less greenhouse gas emissions and without a requirement for arable land (McGonigle et al., 2012), this study indicates that the environmental consequences of mariculture have a negative effect on the general perception of mariculture. While previous studies indicated that diseases, chemical treatments, animal welfare, product quality, and safety are major environmental issues (Tiller et al., 2014), the results in this study indicate that the primary concern is related to the ocean and water quality. Specifically, worries relate to the pollution of the sea, both at the sea bottom and in the bays and beaches. This confirms previous research by Memery and Birch (2016) and calls for unbiased information provision by independent and trustworthy actors. In contrast to Memery and Birch (2016), this study indicates that the perceived environmental impacts of mariculture are likely to have an effect, though they are indirect through general mariculture attitudes, on resistance behaviour among locals. It should be noted, however, that existing concerns are a temporary snapshot, partly based on little information or disinformation. Constructive discussions involving different stakeholders as well as unbiased information are therefore crucial and may very well change this situation in the long term.

Tourism and mariculture compete for the same resource, i.e., water (Ryan et al., 2017). Competition for the use of coastal areas impinges upon and limits other uses such as tourism and reduces access, resulting in a major source of conflict (Nimmo & Cappell, 2009; Tiller et al., 2014). Additionally, the findings of Memery and Birch (2016) suggest a negative relationship between leisure/tourism interest and attitudes towards mariculture. This study does not support previous findings proposing attitudinal connections between these two

industries among the local population (Andereck & Vogt, 2000). This means that local residents seemingly do not perceive tourism and mariculture as competing industries and they do not perceive potential synergies between tourism and mariculture. The nonsignificant relationship between tourism attitudes and mariculture attitudes is interesting as well as surprising from both the competition perspective and the synergy perspective. Further research should focus on the perceptions of important stakeholders such as restaurants, hotels, and activity centres as opposed to those of the local population. Furthermore, there might be group-based variations in attitudes towards mariculture among locals (positive and negative), which should be studied further. For example, people living in attractive houses close to the ocean may perceive conflicting interests, whereas others, for example, those working in the tourism industry, may be inclined to see synergies.

As noted in previous studies (Memery & Birch, 2016), this study found evidence of a strong positive relationship between the perceived economic impacts of mariculture and general attitudes towards mariculture development. Unlike previous studies, we have also tested the relationship between general attitudes towards mariculture and resistance behaviour and found a strong negative relationship.

7. **Theoretical and policy implications**

Together with previous studies on mariculture development (e.g. Chu et al., 2010; Fernández-Polanco & Luna, 2012; e.g. Freeman et al., 2012; Memery & Birch, 2016; Whitmarsh & Wattage, 2006), our findings suggest the possibility of incorporating resistance behaviour in the attitudinal models of mariculture stakeholders. This inclusion has both theoretical and practical implications. On the theoretical side, we align ourselves with the findings of other studies (Brehm & Brehm, 2013; Burroughs, 2007; Zhang & Sapp, 2013) that to understand local residents' perceptions about mariculture development, we must look

beyond their attitudes. Thus, the empirical evidence suggests that the attitudinal models should be extended by including resistance behaviour as the ultimate dependent variable.

Therefore, lengthening the list of potential causes of resistance behaviour by adopting new frameworks in the understudied mariculture development context considerably expands the scope of the analysis. First, based on the theory of planned behaviour, a comprehensive theoretical framework was developed for the study. Previous studies have, to a large extent, been exploratory in nature. Second, the hypotheses have been framed at the theoretical level rather than the observational level in previous studies. Third, the correspondence between the theoretical and observational levels is shown by measures with adequate evidence of validity and reliability, contributing to a more comprehensive understanding of the resistance intention of important mariculture stakeholders. Fourth, this is among the first studies to apply an SEM approach. Theories in social sciences (e.g., those about attitudes towards mariculture) involve complex patterns of relationships between a multitude of constructs, conditions or groups. SEM allows us both to model and test complex patterns of relationships, including a multitude of hypotheses simultaneously as a whole. The use of other methods would frequently require several separate analyses.

Our results can shed new light on mariculture development strategies. First, the nonsignificant relationship between tourism attitudes and mariculture attitudes indicates that destinations relying on or aiming to develop the tourism industry should not consider mariculture in the same region as a competing industry. There may even be synergies if the tourism and mariculture industries jointly develop strategies to develop products. Local products will add value to the tourists' experiences, which will increase the likelihood that they will be willing to pay a premium price during their stay at the destination.

Second, the positive effects of the economic consequences of mariculture suggest that it can be used as a foundation for advising policymakers to promote the positive economic

impacts of mariculture. The negative effect of the environmental impacts, the concerns of locals should be discussed and the impacts should be explained thoroughly, preferably by a neutral third party.

Third, the negative relationship between attitudes towards mariculture and resistance behaviour indicates that policymakers should inform and involve important local stakeholders well before establishing mariculture. Otherwise, mariculture development is likely to face passive or even active resistance, which may eventually change into acceptance and support once the positive impacts of mariculture are propagated among stakeholders and the local community.

8. Limitations

The present study offers new ideas to the established research on mariculture development as well as on the resistance to mariculture development and its antecedents. However, the conceptualization and measurement of resistance to mariculture development is adapted from existing measurement scales used in other domains. Exploratory research should be carried out to further develop and validate this or/and other scales that can be used for the characteristics and idiosyncrasies of the mariculture development context. This study is also based on a moderate-sized non-probability sample of local residents in only one region in Sweden. As such, generalizations, if any, should be made primarily within this local context. Mariculture development is, however, an activity that is expanding in many regions globally, and it can be speculated that similar results would be found in other countries, especially in regions that are similar to the Bohus region in Sweden. Comparative studies of attitudes and behaviours towards mariculture development should be carried out.

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