



# A segmentation of residents' attitudes towards mariculture development in Sweden

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## 1. Introduction

The farming of aquatic organisms, including fish, molluscs, crustaceans, and aquatic plants, is regarded as a promising strategy for local development (Cai et al., 2010; Cai et al., 2006; Costa-Pierce, 2016). Fresh water aquaculture is the dominant form of fish farming in Asia and is the largest component of China's aquaculture production (FAO, 2014). Mariculture, or marine aquaculture, has expanded by 9.3% in production since 1990 (Campbell and Pauly, 2013; FAO, 2010). Earnings from the mariculture sector (FAO, 2014) reached 65.4 billion USD in 2013, and this represents 43.5% of the total aquaculture income. Research shows that mariculture contributes to economic development while having moderate environmental impacts (Bosire et al., 2015; Katranidis et al., 2003). Fish are more efficient converters of energy and protein compared with land-based livestock farming (Gjedrem et al., 2012). Therefore, mariculture is regarded as promising in regard to working towards the UN Sustainable Development Goals, especially goal 2 (i.e. zero hunger) and goal 12 (i.e. responsible consumption and production).

This necessitates mariculture development in new regions and also in Europe. The European Union intends to boost the aquaculture sector through its Blue Growth Agenda. The Commission and EU countries are collaborating to help increase the sector's production and competitiveness. The Commission is helping with the identification of bottlenecks but also facilitates cooperation, coordination, and exchange of best practices between EU countries. In the wake of the initiative, the European Union, for example, funded the "Mediterranean aquaculture integrated development (MedAID)" project in the frame of Horizon 2020 with the purpose of increasing the competitiveness and sustainability of the Mediterranean marine fish-farming sector. Another example is the Swedish government's national strategy to develop the mariculture industry to become a profitable and sustainable production industry with ethical production standards.<sup>1</sup>

Mariculture development needs to be carefully managed and incorporated into existing industrial and societal structures, which may entail trade-offs in terms of, e.g., reduced recreational values, limited

accessibility, and environmental impacts (Krause et al., 2015; Outeiro et al., 2018; Whitmarsh and Wattage, 2006). "Social licence to operate" (SLO) (Demuijnck and Fasterling, 2016) indicate that mariculture activities are considered legitimate in the eyes of the society, and the expression is often used in the context of a possible disapproval of their activities and may result in resistance that can harm the mariculture development. A SLO is clearly a significant element in successful resource development. When interests and values come into conflict with new mariculture development, the community may exercise its ability to withhold SLO.

Legislation and local support (i.e. SLO) have been pointed out as the prevalent barriers to mariculture development, not least in Europe (Krause et al., 2015; Theodorou et al., 2015; Thilsted et al., 2016). Armbrrecht and Skallerud (2019) show that mariculture development needs to take into account the attitudes of local residents to avoid resistant behaviour. The environmental and economic aspects of aquaculture seem to be central themes for the formation of citizens' attitudes and the extent to which mariculture can hope for local support during the development process (Freeman et al., 2012; Memery and Birch, 2016).

In the case of mariculture development, knowledge gaps and misconceptions may lead to negatively biased attitudes among groups of citizens representing a 'science-policy gap' (Bradshaw and Borchers, 2000; Fischhoff, 2012; Krause et al., 2015). A deeper understanding of the attitudes of the local population is thus needed to provide more reliable information about realistic consequences of mariculture development (Fischhoff, 2012). Understanding what people think about aquaculture development will also facilitate informed debate and policymaking (Armbrrecht and Skallerud, 2019). Future mariculture development requires a good understanding of how people think they will be affected. This allows for the development of well-designed programmes to reach out and engage people in developing solutions to the many complex challenges facing decision-makers and mariculture advocates (Clarke et al., 2007). Taking the needs and threats of the local population as a point of departure for mariculture development suggests new locations based on articulated needs and a promising avenue

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<sup>1</sup> Jordbruksverket 2012: Svenskt vattenbruk – en grön näring på blå åkrar. Strategi 2012–2020.

to find modified, suitable, and socially sustainable mariculture concepts for various locations.

However, people differ in opinions and attitudes. Classifying local residents into different groups based on their attitudes towards mariculture recognises that they are different and have different opinions, and it helps to deal with the range of differences (Whitmarsh and Wattage, 2006). Identifying and profiling segments of the local resident communities based on their attitudes will provide decision makers and mariculture advocates a richer understanding of the potentially affected residents. The results can inform policymaking, information strategy development, and evaluation of information campaigns (Hastings and Domegan, 2013). To the best of our knowledge, no other studies have investigated attitudes towards mariculture among different segments of local resident communities. Based on previous studies, the aim of this study is therefore to identify local resident segments on the west coast of Sweden based on their perceptions of the economic and environmental consequences of mariculture development.

The following research questions will be examined in this paper:

1. Based on perceived economic and environmental consequences of mariculture development, what segments can be identified in the residents of west coast Swedish communities?
2. How can these segments be profiled based on values, attitudes, and socio-demographic variables?

## 2. Theoretical background

Segmentation, the process of dividing up a population into homogeneous segments and developing unique programmes and tactics for individual target segments, while perhaps ignoring certain segments, is fundamental to social marketing (Donovan and Henley, 2010). The same logic can be applied to the public in new mariculture development regions. Segmentation extends beyond traditional demographic or geographic targeting and draws on behavioural and psychographic data to assist mariculture advocates to strategically define target groups which have common characteristics; it then tailors intervention appropriately, thereby catering to different attitudes and needs (Rundle-Thiele et al., 2015).

The success of segmenting lies in the choice of the variables used for segmenting and profiling (Dietrich et al., 2017). Economic development in the local community is an important driver of mariculture development. On the other hand, there are also some significant environmental disadvantages associated with mariculture development (Armbrecht and Skallerud, 2019; Freeman et al., 2012; Memery and Birch, 2016). We have therefore chosen to cluster the respondents based on variables that are found in the literature related to the perceived economic and environmental consequences of mariculture development. The segments are profiled based on their value orientations, resistance intentions, conflicts of interest, and socio-demographic variables. Hence, we expect that different segments will show differences in perceived consequences of mariculture development.

### 2.1. Perceived consequences of mariculture development

A few studies have investigated attitudes towards mariculture in general either among the public (e.g. Fernández-Polanco and Luna, 2012; Freeman et al., 2012; Whitmarsh and Wattage, 2006) or different stakeholders (e.g. Chu et al., 2010; Memery and Birch, 2016). Those studies have been related to mariculture in general except for the work of Memery and Birch (2016) who explored attitudes among stakeholders in southwest England, a region new to mariculture development. Our study is also related to mariculture development in a new region, i.e. the west coast of Sweden. We define perceived consequences of mariculture development as the costs and benefits perceived by the residents in the region. Memery and Birch (2016) found that a group of commercially focused stakeholders was positive towards mariculture

development in their region and emphasised the commercial opportunities developing from mariculture. Another group of stakeholders in Memery and Birch's study focused on environmental and marine preservation. This group had a more neutral to negative view and were concerned about the impacts of mariculture development on the surrounding habitat. A similar study carried out by Freeman et al. (2012), investigated attitudes towards mariculture in Germany and Israel. Among their findings, a negative relationship between environmental concerns and general attitude towards mariculture was supported in the Israeli sample but not in the German sample. Both Memery and Birch (2016) and Freeman et al. (2012) illustrate that mariculture development in new regions is perceived to have both economic and environmental consequences.

These factors have been linked in previous literature to stakeholder opinions about mariculture. We therefore propose that economic and environmental consequences influence the local residents' attitudes towards mariculture development in their region. Based on the perceived economic and environmental consequences of mariculture development, segments among local residents are identified to answer our first research question.

### 2.2. Residents' value orientations

Inglehart (1971) proposed a theory of value consisting of materialist values and post-materialist values. He argued that value priorities in advanced industrial society tend to shift away from materialist values (i.e. economic and physical security) towards post-materialist values (i.e. freedom, self-expression, and quality of life). If this shift has taken place, it may have implications for the local residents' value orientation as well. We are using Schwartz's (2006) conceptualisation of general basic human values (e.g. equality, freedom, and universalism) and "assigned values" to understand if and how value orientation might influence residents' attitudes towards mariculture. Assigned values is an umbrella term for both use and non-use values and represents specific values that people attribute to an object, including the environment (e.g. economic, conservation, recreation, and aesthetic values) (Clayton and Myers, 2015; Kiley et al., 2017). Mariculture development in new areas implies exploitation of coastal and marine ecosystems (Gjedrem et al., 2012). The consequences of ecosystem changes in terms of social welfare highlight the need for a balance between the use and preservation of the ecosystem (Liu et al., 2010; Sukhdev, 2008). The costs or benefits of losing or preserving the ecosystem can be broadly classified into "use values" and "non-use values" (Bateman, 2002; Turner et al., 2003). The utilitarian or practical exploitation of nature refers to "use values". These values can be divided into direct (e.g. food products), indirect (e.g. water filtration), and option values (e.g., the ability to use ecosystem goods and services in the future). "Non-use values" refer to values given by individuals to the ecosystem isolated from current or future uses (Marre et al., 2015a; Marre et al., 2015b). They can be divided into two categories: bequest (i.e. future generations will have the ability to derive nature's benefits) and existence values (i.e. intrinsic value is derived from the knowledge of the existence of environmental assets) (Laurila-Pant et al., 2015).

Local residents' value orientations capture their views regarding the protection, utility, and management of the marine environment. These values, assigned or general, influence people's specific attitudes and preferences (Clayton and Myers, 2015; Dietz et al., 2005; Kiley et al., 2017). We therefore assume that both use and non-use values affect local residents' perceptions of the consequences of mariculture development. We assessed the residents' value orientations following Hynes et al. (2014).

### 2.3. Residents' resistance intentions

We assume that the residents' resistance intentions are associated with their perceptions of the consequences of mariculture development.

The perceived independence of the residents may be impeded by mariculture development, especially if development is perceived as negative. Based on psychological reactance theory (Brehm and Brehm, 2013; Zhang and Sapp, 2013), individuals will be encouraged to regain independence by participating in resistance behaviours (e.g. petitions, appealing and protesting against mariculture permissions, organising resistance among local residents, newspaper posts) (Burroughs, 2007). Mariculture advocates such as the mariculture industry associations, local mariculture entrepreneurs, and policymakers will normally view this resistance as negative. Another understanding of this resistance intention could be that it is both productive and useful. Insightful feedback has potential value for developing mariculture expansion plans.

#### 2.4. Conflicts of interest

Mariculture may create externalities and is therefore most likely to affect residents' attitudes in coastal areas. One demonstrated negative effect of mariculture (i.e. external costs) is the degradation or loss of critical marine habitat, which may in turn lead to a reduction in biodiversity and, in some cases, the removal of an important natural resource that provides a range of products and services (Holmer et al., 2007).

A second way in which mariculture can impact society is to affect the leisure value of coastal areas. The effects of mariculture on residents' and tourists' leisure interests are controversial because the co-existence of the two industries may lead to both beneficial and conflicting impacts (Holmer et al., 2007). Freeman et al. (2012) found that residents who experience benefits from the tourism industry (e.g. employment) may be less likely to support mariculture development, and they will develop negative attitudes towards mariculture in general due to potential conflicting interests associated with the use of the resources, specifically, water and the coast (Freeman et al., 2012; Hofherr et al., 2015). Armbrecht and Skallerud (2019) found neither a negative nor a positive relationship between tourism attitudes and attitudes towards mariculture development. Katranidis et al. (2003) found that mariculture development might negatively affect public attitudes. The residents of the villages close to mariculture farms were most concerned with reduced landscape aesthetics and, to some extent, leisure opportunities, which would be constraints on using the shoreline for activities such as bathing, fishing, and boating. The positive impacts of mariculture are considered to be the provision of high-quality fish for tourists and restaurants and that mariculture may be a tourism attraction itself (O'Connor et al., 1992). These findings are significant because they demonstrate that mariculture enterprises may alienate the inhabitants of these areas, especially if the establishment of mariculture restricts other uses of the same resource.

#### 2.5. Socio-demographics

Little research exists on predicting attitudes towards mariculture based on socioeconomic characteristics. Katranidis et al. (2003) make an attempt to explain residents' and tourists' attitudes according to their socioeconomic characteristics and the levels of disturbance they experience from mariculture. Their findings suggest that people are more likely to develop a positive attitude towards mariculture farms if they are visitors to the islands rather than permanent residents. Katranidis et al. (2003) also found that respondents living close to the seashore where the fish cages are situated were more likely to exhibit negative attitudes towards mariculture development. Whitmarsh and Wattage (2006) included the socioeconomic characteristics of respondents to predict attitudes towards the environmental impacts of aquaculture. They revealed that income was a positive predictor and that the number of family members was a negative predictor of their environmental preferences. Mazur and Curtis (2006) found that females living close to coastal areas and those with higher education had stronger

environmental concerns than other socioeconomic groups.

We theorise that local residents' resistance intentions, their value orientations, conflicts of interest, and socio-demographic characteristics are significant profiles of the identified segments of local residents based on economic and environmental consequences.

### 3. Methodology

#### 3.1. Data collection

The target population for this study are residents in three municipalities on the west coast of Sweden. Residents are broadly and inclusively defined as (1) people who have their primary place of residence within one of the municipalities and/or (2) residents who own a second home (i.e. summer house) in one of the three municipalities but have their primary place of residence in another municipality. Second homeowners do not live within one of the municipalities on an everyday basis, but they are still regarded as having considerable socio-cultural, economic, and environmental interests in the studied area.

To study the two groups, two random samples were drawn. Local residents living in one of the municipalities were drawn from a complete list of local residents provided by the national bureau of statistics (Statistics Sweden). Second homeowners were drawn from a complete list of property owners within each municipality (cadastre retrieved from the Swedish Real Property Register). A data collection company (TNS Kantar Sifo) conducted telephone interviews to collect the data (each interview took about 15 min). Several constructs in relation to mariculture development were measured by the questionnaire, including the perceived economic and environmental consequences, behavioural intents, attitudes and beliefs, and value orientations. Socio-demographic variables were also included.

Of 1656 respondents who were contacted, 996 did not yield any data due to unavailability during the data collection process. In total, 660 responses were obtained, representing a response rate of 40%. Of these, 422 were local residents, and 238 were second homeowners. The mean age for both residents and second homeowners was higher than the official statistics. There is also a skew in the gender distribution in both subsamples.

#### 3.2. Measures

In developing measures to represent the economic and environmental consequences of mariculture development and profiling variables, we synthesised scales from the literature with those obtained in our fieldwork. The initial measures were refined and pretested to enhance face validity. Below, we describe how the constructs were operationalised.

The *economic and environmental consequences* were measured by eight indicators of economic consequences and ten indicators of environmental consequences (see Table 1). The indicators were based on and developed in line with the questionnaire used by Freeman et al. (2012) and D'Anna and Murray (2015). The indicators were measured on a 5-point Likert scale anchored by "totally disagree" (1) and "totally agree" (5). The *residents' value orientations* were based on the work of Hynes et al. (2014). The scale included four items measuring use values and six items measuring non-use values. The *residents' resistance intentions* are conceptualised as individuals' planned choices to carry out a particular behaviour in the future (Conner et al., 2002; Malle and Knobe, 1997). Four items were retrieved from the organisational 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. The *conflicts of interest* were adapted from Freeman et al. (2012) and were measured by 17 statements of attitude evaluation. Principal component factor analyses with the Varimax rotation were used (IBM SPSS Statistics 25) to assess the value orientations, resistance intentions, and conflicts of interest dimensions. The

**Table 1**

Cluster descriptors based on mean scores of perceptions of economic and environmental consequences ((1) indifferent residents, (2) optimistic but environmentally pessimistic residents, and (3) optimistic residents).

	(1)	(2)	(3)	F-value <sup>a</sup>	Scheffe post hoc test
	49%	26%	25%		
	(n = 326)	(n = 170)	(n = 164)		
<b>Economic consequences:</b>					
Development of aquaculture in the municipality is a good idea.	3.1	4.3	4.5	147.43	2,3 > 1
Aquaculture is a good alternative to traditional fishing.	2.9	4.0	4.0	80.96	2,3 > 1
Residents in my municipality should see aquaculture as part of life here at the coast.	3.2	4.0	4.5	103.63	2,3 > 1
The benefits of aquaculture outweigh its disadvantages.	3.0	4.4	4.3	157.71	2,3 > 1
Aquaculture creates sustainable jobs for the municipality.	3.1	4.3	4.2	100.15	2,3 > 1
Aquaculture attracts more tourists to the municipality and strengthens the local economy.	2.4	3.5	3.2	45.29	2,3 > 1
My municipality would not profit from establishing aquaculture.	3.0	4.3	2.3	110.40	2 > 1 > 3
I do not think the locals fill the local jobs in aquaculture.	2.9	4.0	2.6	65.18	2 > 1 > 3
<b>Environmental consequences:</b>					
Aquaculture produces healthy fish.	2.9	4.1	3.9	75.48	2,3 > 1
If the fish in the cages are healthy, aquaculture does not harm marine environments.	3.0	4.5	3.6	102.75	2 > 3 > 1
Aquaculture destroys the beauty of the coastal area.	3.1	3.6	1.9	97.61	2 > 1 > 3
Aquaculture competes with tourism/recreation.	2.7	3.6	2.0	59.39	2 > 1 > 3
Aquaculture contributes to pollution in the sea and bays.	3.3	4.5	2.5	118.22	2 > 1 > 3
I am concerned that aquaculture causes pollution and changes on the seabed.	3.3	4.0	2.2	99.77	2 > 1 > 3
Aquaculture development in the municipality could make the water cleaner.	3.0	4.8	3.9	133.14	2 > 3 > 1
Aquaculture has no significant impact on the beach ecology.	2.8	4.6	3.3	126.47	2 > 3 > 1
The presence of aquaculture equipment reduces my enjoyment on the beach.	2.9	3.9	1.8	99.67	2 > 1 > 3
Seeing aquaculture-related waste washed up on the shoreline reduces my support to the industry.	3.7	4.8	3.1	72.52	2 > 1 > 3

<sup>a</sup> Significant at 0.000-level.

**Table 2**

Differences in values and attitudes between the clusters ((1) indifferent residents, (2) optimistic but environmentally pessimistic residents, and (3) optimistic residents).

	(1)	(2)	(3)	F-value (p)	Scheffe post hoc test
Resistance intentions ( $\alpha = 0.91$ ):	2.2	2.7	1.3	66.26 (0.000)	2 > 1 > 3
Value orientation					
Culture and recreation ( $\alpha = 0.69$ ):	4.1	4.4	4.2	10.63 (0.000)	2 > 1,3
Use and management ( $\alpha = 0.75$ ):	4.2	4.5	4.2	19.70 (0.000)	2 > 1,3
Conflicts of interest					
Attitude towards sailing and fishing ( $\alpha = 0.66$ ):	2.8	2.5	3.0	6.70 (0.001)	3 > 2
Attitude towards beach life and swimming ( $\alpha = 0.70$ ):	3.4	3.4	3.4	0.13 (0.875)	n.s.
Attitude towards tourism ( $\alpha = 0.78$ ):	4.0	4.2	4.4	17.69 (0.000)	2,3 > 1

factor analyses resulted in two value dimensions, one resistance dimension, and three conflicts of interest dimensions (see Table 2 and Appendix 1). The *sociodemographic characteristics* included gender, age, educational background, occupation, income, place of residence (distance to the sea), permanent resident vs second homeowners, and municipality where they reside.

3.3. Analytical procedures

The purpose of the analysis was to classify local residents into groups based on their perceptions of economic and environmental consequences. The focus of the present study is to discover a pattern among a list of consequence variables. To determine whether the residents could be grouped according to their perceived consequences, a TwoStep cluster analysis with log-likelihood distance measure was performed (IBM SPSS Statistics 25). This procedure combines sequential and hierarchical approaches by first preclustering and then sub-clustering the data. The number of clusters was determined by the use of the Bayesian information criterion, i.e. a criterion for model selection among a finite set of models; the model with the lowest BIC is preferred (Chen and Gopalakrishnan, 1998). Variable scores were used as inputs in the cluster analysis. To profile the segments, the value orientations, resistance intentions, conflicts of interest, and socio-demographic variables were used. The segments were profiled with univariate

ANOVAs and cross-tabulations (with Pearson's  $\chi^2$  statistic to test significant differences).

4. Results

The TwoStep analysis produced a sample (N = 660), with a silhouette measure of cohesion and a separation of 0.3. The silhouette measure averages, over all records,  $(B - A)/\max(A, B)$ , where A is the record's distance to its cluster centre and B is the record's distance to the nearest cluster centre to which it doesn't belong (Kaufman and Rousseeuw, 1990). A value of 0 means, on average, that cases are equidistant between their own cluster centre and the nearest other cluster. A silhouette of more than 0.0 is needed for the within-cluster distance and between-cluster distance to be valid (Norušis, 2011). A cross-validation of the identified segment was carried out by dividing the total sample by half and repeating the identical analysis on each half of the sample (Punj and Stewart, 1983). The results from the cluster analysis are presented in Table 1.

The residents were clustered into three distinct segments. We labelled the segments: (1) "The indifferent residents" – 49%, (2) "Economically optimistic but environmentally pessimistic residents" – 26%, and (3) "Optimistic residents" – 25%. Then, individual predictor importance scores of the variables (ranging from 0 = least important to 1 = most important) were assessed. The most distinguishing factor,

**Table 3**  
Socio-demographic differences between the clusters.

	(1)	(2)	(3)	Significance test
Gender				
Men:	49%	37%	65%	$\chi^2 = 25.46$ (0.000)
Female:	51%	63%	35%	
Age:	61 y	65 y	59 y	F = 8.60 (0.000)
Education				
Primary/lower secondary school:	13%	19%	12%	$\chi^2 = 10.00$ (0.040)
High school/vocational school:	35%	41%	33%	
University degree:	52%	40%	55%	
Occupation				
Working:	49%	33%	59%	$\chi^2 = 21.73$ (0.000)
Retired:	51%	66%	41%	
Income				
SEK < 200 k:	19%	31%	9%	$\chi^2 = 29.36$ (0.000)
SEK 200–300 k:	27%	23%	23%	
SEK 300–400 k:	22%	23%	22%	
SEK > 400 k:	32%	23%	33%	
Distance from residence to sea				
< 500 m:	51%	29%	20%	$\chi^2 = 5.00$ (0.082)
> 500 m:	49%	24%	28%	
Resident or second homeowner				
Resident:	67%	59%	62%	$\chi^2 = 3.08$ (0.214)
Second homeowner:	33%	41%	38%	
Municipality				
Lysekil:	37%	28%	31%	$\chi^2 = 4.90$ (0.298)
Orust:	31%	38%	34%	
Sotenäs:	32%	34%	35%	

with a predictor importance score of 1.0, was “*The benefits of mariculture outweigh its disadvantages*”, followed by “*Development of aquaculture in the municipality is a good idea*” (0.91), and “*Mariculture development in the municipality could make the water cleaner*” (0.69). The least important factor was “*Mariculture attracts more tourists to the municipality and strengthens the local economy*” (0.33).

ANOVA was used to explore differences in the respondents' values and attitudes among the clusters (Table 2). There were significant differences ( $p < .05$ ) in all value measures, resistance intentions, and conflicts of interest measures except attitude towards beach life and swimming. Chi-square analyses were used to explore the differences in the demographics among the three clusters (Table 3). There were significant ( $p < .05$ ) inter-cluster differences in all of the demographics except for the distance of the residence from the sea, residents vs. second homeowners, and the residents' municipality. These results provide evidence that our clusters are reliable. Each segment is discussed in detail below.

#### 4.1. Segment 1: Indifferent residents

This segment is the largest among the three clusters (49%). These residents' mean scores for perceived economic and environmental consequences range between 2.7 and 3.3, i.e. neither agree nor disagree. Two exceptions are found. They do not think that mariculture will attract more tourists to the local municipality and they will not support the industry if mariculture-related waste is washed up on the local shorelines.

In regard to value orientations, this segment assesses both use and non-use values (i.e. culture and recreation) related to the sea relatively highly but not as highly as the assessments of segment 3. Their attitude towards sailing and fishing is indifferent, and their attitude towards tourism is positive but not as positive as the attitudes of the other segments. They have a low intention to protest against mariculture development. In regard to the socio-demographic profile, this cluster is composed of a 50/50 split between men and women, and the average age is 61 years. This cluster, together with cluster 3, has the largest share of residents with university degrees (52%), and one third of the residents in this cluster have gross incomes in the highest interval.

Approximately half of the cluster is working, and the rest are retirees. There are no significant differences across the municipalities, whether they are residents or second homeowners or have residences that are distant from the sea.

#### 4.2. Segment 2: Economically optimistic but environmentally pessimistic residents

This segment consists of approximately one quarter of the residents (26%). The mean scores on economic consequences range between 4.3 and 3.5, indicating that residents in this segment have a rather optimistic view of the economic consequences of mariculture development in their municipalities. Mean scores of perceived environmental consequences show an opposite opinion. They range from 3.6 to 4.8, indicating a rather pessimistic view of the environmental consequences of future mariculture development.

In regard to value orientations, this segment assesses both use and non-use values (i.e. culture and recreation) related to the sea significantly more highly compared with the assessments of the other two segments. Their attitudes towards sailing and fishing are relatively negative, but their attitude towards tourism is relatively positive. They also have a significantly higher intention to protest against mariculture development even though massive protests from this segment of residents should not be expected. Regarding the socio-demographic profile, approximately two thirds of the residents in this segment are female and retired from work. The average age is highest in this segment (65 years). This segment has the smallest share of residents with university degrees (40%) and the largest share of residents in the lowest income interval.

#### 4.3. Segment 3: Optimistic residents

The third segment is similar in size (25%) to the segment above. The mean scores of perceptions of economic consequences are as high as the above cluster, with two exceptions. Although they are optimists, they do not think that mariculture development will benefit the local municipality or create jobs for the locals. This cluster anticipates a low impact on the environment from mariculture development. In general, they think that mariculture will not affect the local environment and ecosystem.

In regard to value orientations, this segment also considers use and non-use values (i.e. culture and recreation) related to the sea but not as much as segment 2. Their attitudes towards sailing and fishing are significantly higher than that of segment 2, and they have the most positive attitude towards tourism. Their intention to protest against mariculture development is significantly lower compared with those of the other segments. Regarding the socio-demographic profile, approximately two thirds of the residents in this segment are men, and 60% are working. The average age is lowest in this cluster (59 years). The segment has the highest share of residents with university degrees (55%) and the largest share of residents in the highest income interval.

The differences found across the segments for the differentiating variables can provide the basis for developing information and communication strategies to target the segments differentially. Table 4 provides thumbnail sketches of the three segments based on the above differences.

## 5. Discussion, implications, and conclusions

### 5.1. Discussion

The purpose of this research was to segment and profile local residents based on their perceived consequences of mariculture development. In the theoretical section of the paper, economic and environmental consequences were identified and related to mariculture development. Local residents' perceptions of the consequences of

**Table 4**  
Thumbnail sketches of the three segments.

**Segment 1: Indifferent residents (50%)**

- Indifferent on almost all economic and environmental consequences.

*Value orientation:*

- Value culture and recreation related to the sea
- Value the use and management of the sea

*Conflicts of interest:*

- Positive attitude towards tourism
- Indifferent attitudes towards sailing/fishing

*Resistance intentions:*

- Will not protest against mariculture development

*Socio-demographics:*

- Both male and female
- Relatively highly educated
- Relatively high income
- Both working and retired

**Segment 2: Economically optimistic but environmentally pessimistic residents (25%)**

- Optimistic view on economic consequences
- Pessimistic view on environmental consequences

*Value orientation:*

- Highly value culture and recreation related to the sea
- Highly value the use and management of the sea

*Conflicts of interest:*

- Positive attitude towards tourism
- Negative attitudes towards sailing/fishing

*Resistance intentions:*

- Highest likelihood to protest against mariculture development

*Socio-demographics:*

- Females
- Oldest
- Low education
- Low income
- Retired

**Segment 3: Optimistic residents (25%)**

- Optimistic view on both economic and environmental consequences

*Value orientation:*

- Value culture and recreation related to the sea
- Value the use and management of the sea

*Conflicts of interest:*

- Very positive attitude towards tourism
- Indifferent attitudes towards sailing/fishing

*Resistance intentions:*

- No intention to protest against mariculture development

*Socio-demographics:*

- Men
- Youngest
- Well educated
- Highest income
- Working

mariculture formed the basis for segmentation of the residents. Furthermore, factors (i.e. value orientations, conflicts of interest, resistance, and socio-demographics) were identified and discussed for profiling purposes. Table 4 sums up the findings. The results show that the perceived economic and environmental consequences are reliable indicators to identify reasonable and descriptive segments among residents who will potentially be affected by future mariculture development. The results clearly reveal that segments do exist in regard to their perceived consequences. Hence, this study contributes to the literature on social and economic conditions for sustainable mariculture development.

This paper illustrates how cluster analysis can be used by mariculture advocates (e.g. mariculture industry associations, local mariculture entrepreneurs, and policymakers) to identify homogenous groups of residents based on their perceived consequences of mariculture development. While segmentation is recommended as a benchmark for social intervention practices (Dietrich et al., 2015, 2017), no studies on the social, economic, and environmental consequences of mariculture that we are aware of have reported the use of segmentation. The overview obtained for each segment (see Table 4) provides insights into perceived consequences by each segment, along with value orientations, conflicts of interest, and socio-demographic profiles that can be used to guide intervention decisions towards mariculture development and be targeted via information and communication efforts. Using the information gathered in this study and the segments that were identified, offerings can be tailored for each segment.

This paper links environmental economics to classical business administration and marketing in describing and operationalising use and non-use values. The way use and non-use values are described and measured (by items) in this study is still rudimentary, but we believe a better understanding of what use and non-use values consist of (from the perspective of locals) will contribute to a better understanding of what these concepts actually mean. This extends the common quantitative monetary values of use and non-use values to a more qualitative measure of what a monetary measure of use value actually means. Consequently, this may facilitate cross-disciplinary research lending relevance to existing and ongoing research in environmental economics and in areas such as policy and planning, destination planning and development, and tourism development.

## 5.2. Policy implications

This paper has important implications for mariculture advocates. We argue that the segmentation approach may be an appropriate method for information and communication efforts as it provides a rich description of segments. This richness can be applied to better frame the planning process. Solutions can then be developed based on this knowledge to change attitudes towards mariculture. Mariculture advocates can also use the approach proposed here as a screening tool for attitudes among locals in new regions for mariculture development. The description may also be used as a basis for initiating a dialogue with locals on how to best develop mariculture. Including the local population when developing new ventures is referred to as co-creation and participatory development (Jernsand, 2016) and may constitute an avenue for future development in the mariculture industry.

The thumbnail sketch of the resident segments will help mariculture advocates to position their information and communication campaigns. They will be provided with deeper insights into local residents' attitudes, which will enable them to make better and more informed decisions. A socially legitimate and politically transparent mariculture development (i.e. SLO) is important when setting policy objectives and should include the voices of the local residents who will be directly and indirectly impacted by policy changes.

Using this insight into the residents, an appropriate information and communication mix can be developed to cater to each segment from those identified. The data can be used to provide relevant activities that are aligned with the current perceptions exhibited by each segment profile. For example, in the current study, residents and second homeowners in three municipalities were included in the survey. We found no significant differences across the segments on those variables, implying that where and whether the stakeholder is a resident or second homeowner has no effect on their perceptions of the consequences of mariculture development in the area. Hence, interventions related to information and communication can target both groups of residents. The largest segment, segment 1, has no strong opinions about mariculture development. The question remains whether this segment

should be approached. If this segment is approached, the message should convince them of the benefits of mariculture development. Segment 2 reports scepticism related to the environmental consequences. This segment includes older retired females with low levels of education. The link between their value orientations and their perceived pessimistic view of environmental consequences should be emphasised. Their value systems are deeply rooted and cannot be easily changed.

Mariculture advocates can use this knowledge to identify the information and communication channels that are most likely to attract residents to their messages aligning mariculture development with their value systems. Approaching segment 3 appears to be the least urgent given their positive view of both the economic and environmental consequences. Spending limited resources on this segment to convince them of the benefits of mariculture development is not necessary given their positive views.

### 5.3. Limitations and future research

Despite some important findings, there are also some limitations in interpreting the results. The data employed are cross-sectional in three Swedish municipalities; thus, definitive statements about causal relationships among variables cannot be made. Future studies should attempt to obtain data from other mariculture development areas or countries to compare and contrast the various segments that may exist within the total groups of residents in the mariculture development areas. In addition, future research should investigate the indifferent residents' segment to discover how and why they are indifferent. This knowledge will assist researchers, educators, and public policymakers in creating effective communication for targeted residents. Future research could also identify through other methods, such as structural equation modelling or regression analyses, whether the perceived

consequences of mariculture development change after exposure to different information and communication messages.

### 5.4. Conclusions

This paper contributes to the literature by outlining a cluster analysis approach to the segmentation of stakeholders who have the potential to be affected by mariculture development in new areas; these findings can be used by mariculture advocates to identify valuable segments and to direct information and communication programme development and implementation. Those advocates can measure a variety of variables (both numeric and categorical) across four segmentation bases (i.e. demographic, psychographic, behavioural and geographic) to identify homogenous segments and to develop offerings specific to each segment. This paper has examined a resident population to gain insights into key segmentation variables with the intention of understanding how future communication interventions can be designed and implemented. This paper also provides practical insight into how segmentation can be undertaken and illustrates how the segments derived can be used to guide the planning and implementation of such programmes.

### Declaration of Competing Interest

None.

### Acknowledgment

This work was supported by a research grant from the Swedish Mariculture Research Centre (SWEMARC) at the University of Gothenburg, Sweden.

## Appendix 1. Appendix

	Mean (SD):	Factor loadings:
Resistance intention ( $\alpha = 0.91$ )		
I plan to look for ways to prevent the change from taking place	2.1 (1.4)	0.86
I plan to protest against the change	2.2 (1.4)	0.88
I plan to present my objections regarding the change to the authorities and mariculture advocates	2.1 (1.4)	0.88
I plan to present my objections regarding the change to the municipal council	2.2 (1.4)	0.89
Value orientation:		
Culture and recreation ( $\alpha = 0.69$ )		
The value of the sea: for culture and identity	3.9 (1.0)	0.80
The value of the sea: for creativity	3.9 (1.0)	0.74
The value of the sea: for recreation and tourism	4.5 (0.7)	0.71
The value of the sea: as a part of the landscape	4.7 (0.6)	0.64
Use and management ( $\alpha = 0.73$ )		
The value of the sea: for education and science	4.3 (0.9)	0.74
The value of the sea: for business	4.1 (0.9)	0.73
The value of the sea: as a producer of energy	3.9 (1.1)	0.67
The value of the sea: as a food source	4.5 (0.8)	0.66
The value of the sea: for trade and transport	4.2 (0.9)	0.62
Conflicts of interest:		
Attitude towards sailing and fishing ( $\alpha = 0.66$ )		
I often use my sailboat or motorboat	2.8 (1.6)	0.87
I like to fish	2.7 (1.6)	0.87
Attitude towards beach life and swimming ( $\alpha = 0.70$ )		
I often go to the beach	3.8 (1.3)	0.88
I often swim in the sea	3.0 (1.5)	0.88
Attitude towards tourism ( $\alpha = 0.78$ )		
I support tourism as having a vital role in this community	4.5 (0.8)	0.85
Tourism holds great promise for my community's future	4.3 (0.9)	0.83
The tourism organisation of my community's government should do more to promote tourism	3.8 (1.1)	0.78
The overall benefits of tourism outweigh its disadvantages	4.2 (0.9)	0.67

## References

- Armbrecht, J., Skallerud, K., 2019. Attitudes and intentional reactions towards mariculture development –local residents' perspective. *Ocean Coast. Manag.* 174, 56–62.
- Bateman, I., 2002. *Economic Valuation with Stated Preference Techniques: A Manual*. Edward Elgar, Cheltenham.
- Bosire, J., Celliers, L., Groeneveld, J., Paula, J., Schleyer, M., 2015. *Regional State of the Coast Report-Western Indian Ocean*. UNEP & WIOMSA, Nairobi, Kenya.
- Bradshaw, G.A., Borchers, J.G., 2000. Uncertainty as information: narrowing the science-policy gap. *Conserv. Ecol.* 4 (1) art 7. <http://www.consecol.org/vol4/iss1/art7/>.
- Brehm, S.S., Brehm, J.W., 2013. *Psychological Reactance: A Theory of Freedom and Control*. Academic Press.
- Burroughs, N.F., 2007. A reinvestigation of the relationship of teacher nonverbal immediacy and student compliance-resistance with learning. *Commun. Educ.* 56 (4), 453–475.
- Cai, J., Leung, P., Mak, J., 2006. Tourism's forward and backward linkages. *J. Travel Res.* 45 (1), 36–52.
- Cai, J., Jolly, C., Hishamunda, N., Ridler, N., Ligeon, C., Leung, P., 2010. Review on aquaculture's contribution to socio-economic development: enabling policies, legal framework and partnership for improved benefits. In: Paper presented at the Farming the Waters for People and Food. Proceedings of the Global Conference on Aquaculture.
- Campbell, B., Pauly, D., 2013. Mariculture: a global analysis of production trends since 1950. *Mar. Policy* 39, 94–100.
- Chen, S.S., Gopalakrishnan, P.S., 1998. Clustering via the Bayesian information criterion with applications in speech recognition. In: Proceedings of the 1998 IEEE International Conference on Acoustics, Speech and Signal Processing, ICASSP '98. 2, pp. 645–648.
- Chu, J., Anderson, J.L., Asche, F., Tudur, L., 2010. Stakeholders' perceptions of aquaculture and implications for its future: a comparison of the USA and Norway. *Mar. Resour. Econ.* 25 (1), 61–76.
- Clarke, J., Newman, J., Smith, N., Vidler, E., Westmarland, L., 2007. *Creating Citizen-Consumers: Changing Publics and Changing Public Services*. Sage.
- Clayton, S., Myers, G., 2015. *Conservation Psychology: Understanding and Promoting Human Care for Nature*. Wiley-Blackwell, Oxford, UK.
- Conner, M., Norman, P., Bell, R., 2002. The theory of planned behavior and healthy eating. *Health Psychol.* 21 (2), 194–201.
- Costa-Pierce, B.A., 2016. Ocean foods ecosystems for planetary survival in the Anthropocene. In: Paper presented at the Keynote Speech at the World Nutrition Forum: Driving the Protein Economy.
- D'Anna, L.M., Murray, G.D., 2015. Perceptions of shellfish aquaculture in British Columbia and implications for well-being in marine social-ecological systems. *Ecol. Soc.* 20 (1), 57.
- Demuijnck, G., Fasterling, B., 2016. The social license to operate. *J. Bus. Ethics* 136 (4), 675–685.
- Dietrich, T., Rundle-Thiele, S., Leo, C., Connor, J., 2015. One size (never) fits all: segment differences observed following a school-based alcohol social marketing program. *J. Sch. Health* 85 (4), 251–259.
- Dietrich, T., Rundle-Thiele, S., Kubacki, K., 2017. *Segmentation in Social Marketing*. Springer, Singapore.
- Dietz, T., Fitzgerald, A., Shwom, R., 2005. Environmental values. *Annu. Rev. Environ. Resour.* 30 (1), 335–372.
- Donovan, R., Henley, N., 2010. *Principles and Practice of Social Marketing: An International Perspective*. Cambridge University Press, Cambridge.
- FAO, 2010. *Integrated Mariculture: A Global Review*. FAO, Rome.
- FAO, 2014. *The State of World Fisheries and Aquaculture: Opportunities and Challenges*. FAO, Rome.
- Fernández-Polanco, J., Luna, L., 2012. Factors affecting consumers'beliefs about aquaculture. *Aquac. Econ. Manag.* 16 (1), 22–39.
- Fischhoff, B., 2012. Communicating uncertainty fulfilling the duty to inform. *Issues Sci. Technol.* 28 (4), 63–70.
- Freeman, S., Vigoda-Gadot, E., Sterr, H., Schultz, M., Korchenkov, I., Krost, P., Angel, D., 2012. Public attitudes towards marine aquaculture: a comparative analysis of Germany and Israel. *Environ. Sci. Pol.* 22, 60–72.
- Gjedrem, T., Robinson, N., Rye, M., 2012. The importance of selective breeding in aquaculture to meet future demands for animal protein: a review. *Aquaculture* 350–353, 117–129.
- Hastings, G., Domegan, C., 2013. *Social Marketing: From Tunes to Symphonies*, 2nd edition. Routledge, Abingdon.
- Helpap, S., 2015. The impact of power distance orientation on recipients' reactions to participatory versus programmatic change communication. *J. Appl. Behav. Sci.* 52 (1), 5–34.
- Hofherr, J., Natale, F., Trujillo, P., 2015. Is lack of space a limiting factor for the development of aquaculture in EU coastal areas? *Ocean Coast. Manag.* 116, 27–36.
- Holmer, M., Black, K., Duarte, C.M., Marbà, N., Karakassis, I., 2007. *Aquaculture in the Ecosystem*. Springer Science & Business Media.
- Hynes, S., Norton, D., Corless, R., 2014. Investigating societal attitudes towards the marine environment of Ireland. *Mar. Policy* 47, 57–65.
- Inglehart, R., 1971. The silent revolution in Europe; intergenerational change in post-industrial societies. *Am. Polit. Sci. Rev.* 65, 991–1017.
- Jernsand, E.M., 2016. *Inclusive Place Branding – What it Is and how to Progress towards it*. Ph.D.-thesis. School of Business, Economics and Law, University of Gothenburg, Sweden.
- Katranidis, S., Nitsi, E., Vakrou, A., 2003. Social acceptability of aquaculture development in coastal areas: the case of two Greek islands. *Coast. Manag.* 31 (1), 37–53.
- Kaufman, L., Rousseeuw, P.J., 1990. *Finding Groups in Data*. John Wiley & Sons, New York.
- Kiley, H.M., Ainsworth, G.B., van Dongen, W.F., Weston, M.A., 2017. Variation in public perceptions and attitudes towards terrestrial ecosystems. *Sci. Total Environ.* 590, 440–451.
- Krause, G., Brugere, C., Diedrich, A., Ebeling, M.W., Ferse, S.C.A., Mikkelsen, E., Pérez Agúndez, J.A., Stead, S.M., Stybel, N., Troell, M., 2015. A revolution without people? Closing the people-policy gap in aquaculture development. *Aquaculture* 447, 44–55.
- Laurila-Pant, M., Lehtikoinen, A., Uusitalo, L., Venesjärvi, R., 2015. How to value biodiversity in environmental management? *Ecol. Indic.* 55, 1–11.
- Liu, S., Costanza, R., Farber, S., Troy, A., 2010. Valuing ecosystem services. *Ann. N. Y. Acad. Sci.* 1185 (1), 54–78.
- Malle, B.F., Knobe, J., 1997. The folk concept of intentionality. *J. Exp. Soc. Psychol.* 33 (2), 101–121.
- Marre, J.-B., Brander, L., Thebaud, O., Boncoeur, J., Pascoe, S., Coglán, L., Pascal, N., 2015a. Non-market use and non-use values for preserving ecosystem services over time: a choice experiment application to coral reef ecosystems in New Caledonia. *Ocean Coast. Manag.* 105, 1–14.
- Marre, J.-B., Thebaud, O., Pascoe, S., Jennings, S., Boncoeur, J., Coglán, L., 2015b. The use of ecosystem services valuation in Australian coastal zone management. *Mar. Policy* 56, 117–124.
- Mazur, N.A., Curtis, A.L., 2006. Risk perceptions, aquaculture, and issues of trust: lessons from Australia. *Soc. Nat. Resour.* 19 (9), 791–808.
- Memery, J., Birch, D., 2016. Exploring attitudes toward aquaculture development in the United Kingdom: a consultative stakeholder approach. *J. Int. Food Agribusiness Mark.* 28 (4), 363–372.
- Norušis, M.J., 2011. *IBM SPSS Statistics 19 Guide to Data Analysis*. Prentice-Hall, Upper Saddle River, New Jersey.
- O'Connor, R., Whelan, B.J., Crutchfield, J.A., O'Sullivan, A., 1992. Review of the Irish aquaculture sector and recommendations for its development. In: *Economic and Social Research Institute (ESRI) Research Series*.
- Oreg, S., 2003. Resistance to change: developing an individual differences measure. *J. Appl. Psychol.* 88 (4), 680–693.
- Oreg, S., 2006. Personality, context, and resistance to organizational change. *Eur. J. Work Org. Psychol.* 15 (1), 73–101.
- Outeiro, L., Villasante, S., Oyarzo, H., 2018. The interplay between fish farming and nature based recreation-tourism in Southern Chile: a perception approach. *Ecosyst. Serv.* 32, 90–100.
- Punj, G., Stewart, D.W., 1983. Cluster analysis in marketing research: review and suggestions for application. *J. Mark. Res.* 20 (2), 134–148.
- Rundle-Thiele, S., Kubacki, K., Tkaczynski, A., Parkinson, J., 2015. Using two-step cluster analysis to identify homogeneous physical activity groups. *Mark. Intell. Plan.* 33, 522–537.
- Schwartz, S.H., 2006. Les valeurs de base de la personne: théorie, mesures et applications. *Rev. Fr. Sociol.* 47 (4), 929–968.
- Sukhdev, P., 2008. *The Economics of Ecosystems and Biodiversity*. European Commission, Brussels.
- Theodorou, J.A., Perdikaris, C., Filippopoulos, N., 2015. Evolution through innovation in aquaculture: a critical review of the Greek mariculture industry. *J. Appl. Aquac.* 27 (2), 160–181.
- Thilsted, S.H., Thorne-Lyman, A., Webb, P., Bogard, J.R., Subasinghe, R., Phillips, M.J., Allison, E.H., 2016. Sustaining healthy diets: the role of capture fisheries and aquaculture for improving nutrition in the post-2015 era. *Food Policy* 61, 126–131.
- Turner, R.K., Paavola, J., Cooper, P., Farber, S., Jessamy, V., Georgiou, S., 2003. Valuing nature: lessons learned and future research directions. *Ecol. Econ.* 46 (3), 493–510.
- Whitmarsh, D., Wattage, P., 2006. Public attitudes towards the environmental impact of salmon aquaculture in Scotland. *Environ. Policy Gov.* 16 (2), 108–121.
- Zhang, Q., Sapp, D.A., 2013. Psychological reactance and resistance intention in the classroom: effects of perceived politeness and legitimacy, relationship distance, and teacher credibility. *Commun. Educ.* 62 (1), 1–25.

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