

Social acceptability of aquaculture: the use of survey-based methods for eliciting public and stakeholder preferences

David Whitmarsh and Maria Giovanna Palmieri

CEMARE, University of Portsmouth

1. Introduction

Aquaculture is one of the fastest growing food producing sectors, and currently contributes just under 40% to world supplies of fish and other aquatic organisms. The benefits of this development are real and visible, both for producing countries (e.g. support for rural livelihoods, improved food security, export earnings) and for consumers in the form of lower prices. Growing concern over the environmental impact of aquaculture, however, has prompted a search for a governance framework that can guarantee sustainability – that is, a financially viable aquaculture industry in which the environmental damage is minimised (World Bank, 2006). Sustainability indicators are an important component of such a governance framework, but should also include some measure of the wider socio-economic costs and benefits of aquaculture.

Ideally what we would like to do is attach a monetary value to the environmental impacts of aquaculture, and in some instances this is possible where a measurable effect on production can be identified. In the case of shrimp aquaculture, for example, the external costs arising from mangrove conversion (e.g. loss of coastal protection, reduced offshore catches, etc.) have been shown by various studies to be substantial (Sathirathai, 1998; Sathirathai and Barbier, 2001; Pongthanapanich and Roth, 2006). In general, however, putting a monetary value on the environmental impacts of aquaculture is complex. This is especially true for cage aquaculture, the dominant production system in Europe. Here the external effects are typically diverse – involving water quality, visual amenity, competition for marine space, and interactions with other species (Holmer et al., 2008). Moreover, the severity of these impacts is likely to vary according to locality, and in some cases may even be beneficial – release of nutrients or organic waste by fish farms may increase the productivity of adjacent capture or culture fisheries. However, while such externalities cannot easily be quantified in monetary terms, they cannot simply be ignored since it is clear that the public are not indifferent to the environmental performance of aquaculture. The most obvious clue to this is the fact that consumers are willing to pay higher prices for farmed fish (e.g. salmon) produced under more environmentally sustainable conditions, but alongside this there is evidence from public attitude studies conducted in the Mediterranean and Scotland that the social acceptability of aquaculture is linked to its perceived environmental impact.

It is precisely this issue of social acceptability that is addressed within the ECASA project. The question asked is: *What do people want from aquaculture?* To answer this, Project Partners at the University of Portsmouth have developed a

survey-based approach which aims to elicit public and stakeholder attitudes towards the environmental performance of aquaculture. Salmon farming in Scotland has been used as a case study, though on the basis of the results we are confident that the methodology can be adapted to other areas and situations (e.g. sea bass or sea bream in the Mediterranean) where the social acceptability of aquaculture is an issue.

2. Methodology and data collection

2.1 Preference elicitation

Public and stakeholder preferences for different salmon farming objectives were elicited using the Analytic Hierarchy Process (AHP), a multi-criteria technique that has been applied to a range of decision problems including natural resource use and fisheries management (DiNardo et al. 1989; Leung et al. 1998; Mardle and Pascoe 1999; Duke and Aull-Hyde 2002; Hall et al. 2004; Herath 2004; Jones and Mardle 2004; Mardle et al. 2004; Nielsen and Mathiesen 2006; Wattage and Mardle 2005; Wattage and Mardle 2006; Whitmarsh and Wattage 2006). AHP is relevant because the performance of the aquaculture industry covers multiple dimensions (e.g. economic, social, environmental, etc.), and the way these have been defined within the survey is given in Figure 1. The selection of these performance indicators is based on policy documents concerning the EU and national government strategy towards aquaculture (CEC, 2002; OECD, 2003; Scottish Executive, 2003), as well as other publications detailing the major issues concerning marine fish farming in general and salmon farming in particular (Muir et al., 1999; Black, et al, 2001; Burbridge et al., 2001).

The purpose of AHP is to derive a numerical score that measures the relative importance of each of the components within the hierarchy, and this is done by asking respondents to make pairwise comparisons between different objectives or criteria. The intensity of preference is conventionally measured on a 9-point scale: 1 indicating that the two objectives are of equal importance, 9 indicating that one objective is of absolute importance compared to the other (Figure 2). These numerical responses form the basis of the pairwise comparison matrix [A], which can be represented as:

$$\begin{array}{cccccc}
 w_1/w_1 & w_1/w_2 & \dots & \dots & w_1/w_n \\
 w_2/w_1 & w_2/w_2 & \dots & \dots & w_2/w_n \\
 : & : & & & : \\
 : & : & & & : \\
 w_n/w_1 & w_n/w_2 & \dots & \dots & w_n/w_n
 \end{array}$$

The vector \mathbf{W} (i.e. $w_1, w_2, \dots w_n$) denotes the weights or importance attached to a set of attributes or objectives. Hence w_i/w_j measures the importance of attribute i relative to alternative j in a given paired comparison. With n attributes, there will be $[n(n-1) / 2]$ paired comparisons. Deriving a set of weights which gives the 'best fit' to the relativities stated in the matrix can be done in a number of ways, the method proposed by Saaty (1977) involving matrix algebra to derive the eigenvector associated with the maximum eigenvalue of the matrix $[A]$. Specialist computer software is available for this (e.g. Expert Choice), though a spreadsheet program such as Excel which has matrix commands may also be employed. A widely used alternative to the eigenvector method involves calculating the geometric mean of each row in the matrix and normalising the result so that the column sums to 1.0 (or 100%). This is the method adopted in the survey, and to illustrate how the scores are derived we consider below the answers given by a single respondent (e.g. one of the stakeholders) to questions concerning the seriousness of the three environmental impacts of aquaculture within a given area. Arranged in the form of the A matrix, the results based on the 9-point scale might be as follows:

	Pollution	Visual intrusion	Wild stock impacts	Row geometric mean	Normalised geometric mean
Pollution	1	8	2	2.52	59.5
Visual intrusion	1/8	1	1/6	0.275	6.5
Wild stock impacts	1/2	6	1	1.442	34.0
				4.237	100.0

The key result is found in the right hand column. The normalised row geometric mean gives us not only an ordinal ranking of impacts in terms of their importance (pollution being the most serious, visual intrusion the least) but numerical scores on a ratio scale.

In our survey we have a total of six criteria (three socio-economic, three environmental), which means that there are potentially 15 paired comparisons if all possible combinations are considered. To simplify the analysis, and to reduce

the burden on respondents of answering this number of questions, the decision problem was split up between the two different levels in the hierarchy. The respondent is first required to make a judgement between the importance of maximising socio-economic benefits and minimising environmental damage; then, within each of those broadly defined objectives, a judgement has to be made about the importance of the different sub-objectives (criteria). This effectively reduces the number of pairwise choices from 15 to seven, as described in Figure 3.

2.2 The public and stakeholder attitude surveys

The public attitude survey was administered to random samples of residents of five Scottish coastal areas where salmon farming is already developed and may possibly develop further in the future. These were:

- * Argyll and Bute
- * Highlands
- * Orkney
- * Shetland
- * Western Isles

A summary profile of these regions is given in Table 1. Samples were selected using the Electoral Registers for Scotland, which were considered to be a more appropriate sampling frame than the Postal Address File. Self-administered questionnaires were sent by mail in the Autumn of 2006 to named householders on the ERs (1000 to each of the five study sites), plus a reply-paid envelope and accompanying letter. A total of 769 questionnaires were returned, of which 745 were usable. In addition to completing the AHP section of the questionnaire, respondents were also asked to express their attitudes towards the future development of salmon farming in Scotland and to answer a set of questions describing their particular circumstances (e.g. employment status) that could be significantly associated with attitudes and preferences.

The survey of stakeholders commenced in Spring 2007, and consisted in total of 39 key representatives of the following interest groups: regulators (5), industry (3), environmental organisations (6), wild fish interests (6), economic development agencies (6), independent experts (10), and consumer organisations (3). The survey instrument was similar to that used for the general public insofar as it included the same set of paired comparison questions in the AHP section. Unlike the public attitude survey, however, stakeholders were not asked to provide any other information. A summary of the main similarities and differences used in the two sets of questionnaires is given in Figure 4.

3. Results

3.1 AHP priority weights

3.1.1 Public attitudes

Responses to the paired comparison questions were converted to numerical scores indicating the relative priority that respondents attached to the various objectives and criteria. The regional breakdown of these weights is given in Table 2. Of the socio-economic objectives, employment and livelihoods commanded the highest score in all five regions, while tax revenue contribution scored the lowest. Of the environmental objectives there was a high and roughly equal scoring given to pollution and wild stock impacts, in contrast to visual intrusion which had a low score. Differences between the regions are also apparent, most noticeably Highland where the greatest weight is given to wild stock impacts (29.0), while in the Western Isles employment and livelihoods scored most highly (31.3).

3.1.2 Stakeholder attitudes

The overall criterion priority weights derived from the stakeholder survey are given in Table 3. As we would anticipate, there are very wide differences between the stakeholders in the importance attached to the various performance criteria, and to a large extent the results correspond with what would be expected *a priori*. This is clearly shown in the case of the economic development agencies and the industry (i.e. producer interests) who, perhaps not surprisingly, placed the emphasis on the role of salmon farming in sustaining employment and livelihoods. Against this is the result for the environmental groups and wild fish interests, who attached a much lower priority to socio-economic benefits and correspondingly more to the need to minimise environmental damage, particularly in respect of pollution and impacts on wild salmon stocks. The pattern of results for other stakeholder groups is not necessarily what might have been expected, however. Independent experts gave a noticeably high weight to employment and livelihoods (44.1), while consumer groups attached the greatest importance to environmental criteria.

3.2 Preferences towards aquaculture development

In the public attitude survey, respondents were asked what they thought would be better for Scotland in terms of salmon farming development over the next few years, given the various positive and negative effects of the industry. The results are given in Table 4. While there is clearly no overwhelming preference in favour either of an increase or a decrease in the scale of the industry, it should be noted that in all five regions the respondents who favoured expansion outnumbered those opting for contraction. This is demonstrated most conspicuously in the Western Isles, where the proportion of respondents favouring an expansion of salmon farming (38%) is higher than in any of the other Scottish regions. This prompts the broader question of whether people's preferences towards aquaculture development are related to the region in which they live. The cross

tabulation and χ^2 results presented in Figure 5 strongly suggest that the pattern of observations derived from the survey is unlikely to have occurred by chance.

To investigate this further, a logistic regression analysis was undertaken to see how far public preferences could be explained statistically by attribute variables (i.e. those specific to the respondent) and context variables (i.e. area and regional characteristics). The results are presented in Figure 6. Respondents who were currently employed in salmon farming, purchased salmon regularly (monthly or weekly) or who had large families were more likely to favour an expansion of the industry. Women were more likely than men to take a negative view of aquaculture development, and likewise if a respondent was a member of an environmental group. Employment status was also found to be significant, with self-employed respondents being less likely to favour expansion. From a policy perspective, however, the more relevant result relates not to any of these attribute variables but to an indicator which measures the economic and social deprivation of an area. This information, which is available at postcode level, was obtained from the Scottish Neighbourhood Statistics database and incorporated with the survey returns. The indicator used (the Scottish Index of Multiple Deprivation, or SIMD) is a composite measure based on income, employment, skills and training, access to services, and a range of other social metrics. Including this as a variable in the regression equation reveals that area deprivation significantly affects attitudes to aquaculture development; respondents in the more economically and socially deprived neighbourhoods were more likely to support an expansion of salmon farming than those elsewhere.

An issue which runs parallel to this analysis is whether preferences towards aquaculture development are related to the priority scores which respondents attached to the various socio-economic and environmental objectives. In Table 5 we show the scores given to the two major categories of objectives – socioeconomic and environmental - in relation to the opinions expressed as regards the future scale of the industry. It is quite clear that those respondents who favoured an *expansion* of salmon farming generally attached the *lowest* priority to minimising environmental damage (and by definition, the highest priority to maximising socio-economic benefits). Conversely, those favouring a contraction of the industry gave the highest weight to environmental performance.

4. Comment and conclusion

Previous research has shown that the social acceptability of aquaculture is closely linked to its perceived environmental impact (Katrinidis et al., 2003; Whitmarsh and Wattage, 2006), and this is consistent with the findings of the present study. The results indicate that public attitudes towards the future of the salmon farming industry are a function of the weights people attach to the beneficial effects of industry expansion (i.e. job creation, etc.) as against the perceived negative effects associated with environmental degradation. These results provide a benchmark against which to compare the findings of the stakeholder survey, which found marked differences in the relative importance attached to the various socio-economic and environmental performance indicators. There is a debate to be had over the implications of these differences,

but at the very least it implies that stakeholder influence over aquaculture policy needs to be judged in terms of how far the preferences of particular interest groups are congruent with those of the public at large. A balance of representation may doubtless be needed to achieve this.

A further important aspect of the research relates to the observed regional differences in public attitudes towards salmon farming. Knowledge of such differences may be useful for policy purposes, particularly area and site selection, but in research terms it is also important to try to explain why some communities may be more favourably disposed to aquaculture development than others. In the present study, part of the explanation surely lies with the varying economic profiles of the five coastal areas. The survey results for the Western Isles - notably the marked preference in favour of aquaculture expansion - seems likely to be due to the fact this is an area where unemployment rates have historically been above those for the rest of Scotland and also that here the jobs density is below that of the other regions surveyed. In the Western Isles, more so than elsewhere, we might therefore expect that attitudes to any industry which creates jobs and sustains livelihoods would be positive. Support for this argument is provided by the statistical analysis showing that neighbourhood characteristics (specifically, area deprivation) have a significant influence on public preferences towards aquaculture development. If that is the case, then it suggests that the way people evaluate the trade-off between the socio-economic and environmental effects of aquaculture cannot be separated from the local and regional context in which such choices are made.

References

- Black, K.D. (ed.) 2001. *Environmental Impacts of Aquaculture*. Academic Press, Sheffield, UK
- Burbridge, P., Hendrick, V., Roth, E. and Rosenthal, H. 2001. Social and economic policy issues relevant to marine aquaculture. *Journal of Applied Ichthyology* 17: 194 – 206
- Commission of the European Communities. 2002. *A Strategy for the Sustainable Development of European Aquaculture*. Communication from the Commission to the Council and the European Parliament. COM(2002) 511 final. Brussels
- DiNardo, G., Levy, D. and Golden, B. 1989. Using decision analysis to manage Maryland's river herring fishery: an application of AHP. *Journal of Environmental Management*. 29: 193-213
- Duke, J.M. and Aull-Hyde, R. 2002. Identifying public preferences for land preservation using the analytic hierarchy process. *Ecological Economics* 42: 131-145
- Hall, C., McVittie, A. and Moran, D. 2004. What does the public want from agriculture and the countryside ? A review of evidence and methods. *Journal of Rural Studies* 20: 211-225
- Herath, G. 2004. Incorporating community objectives in improved wetland management: the use of the analytic hierarchy process. *Journal of Environmental Management* 70: 263 – 273
- Holmer, M., Black, K., Duarte, C.M., Marba, N. and Karakassis, I. (eds). 2008. *Aquaculture in the Ecosystem*. Springer, 270 pp
- Jones, D.F. and Mardle S. 2004. A distance-metric methodology for the derivation of weights from a pairwise comparison matrix. *Journal of the Operational Research Society* 55: 869 – 875
- Katranidis, S., Nitsi, E. and Vakrou, A. 2003. Social acceptability of aquaculture development in coastal areas: the case of two Greek Islands. *Coastal Management* 31: 37-53

Leung, P., Muraoka, J., Nakamoto, S.T. and Pooley S. 1998. Evaluating fisheries management options in Hawaii using analytic hierarchy process (AHP). *Fisheries Research* 36: 171 – 183

Mardle, S. and Pascoe, S. 1999. A review of applications of multiple criteria decision making techniques to fisheries. *Marine Resource Economics* 14: 41-63

Mardle, S., Pascoe, S. and Herrero I. 2004. Management objective importance in fisheries: an evaluation using the Analytic Hierarchy Process. *Environmental Management* 33(1): 1-11

Muir, J.F., Brugere, C., Young, J.A. and Stewart, J.A. 1999. The solution to pollution ? The value and limitations of environmental economics in guiding aquaculture development. *Aquaculture Economics and Management* 3(1): 43-57

Nielsen, J.R. and Mathiesen, C. 2006. Stakeholder preferences for Danish fisheries management of sand eel and Norway pout. *Fisheries Research* 77: 92 – 101

OECD 2003. *Review of Fisheries in OECD Countries: Policies and Summary Statistics*. Organisation for Economic Cooperation and Development, Paris, France.

Pongthanapanich, T. and Roth, E. 2006. Toward Environmental Responsibility of Thai Shrimp Farming through a Voluntary Management Scheme. IME Working Paper 70/06, Department of Environmental and Business Economics, University of Southern Denmark

Saaty, T.L. 1977. A Scaling Method for Priorities in Hierarchical Structures. *Journal of Mathematical Psychology* 15(3): 234-281.

Sathirathai, S. 1998. Economic valuation of mangroves and the roles of local communities in the conservation of resources: case study of Surat Thani, South of Thailand. Final Report Submitted to the Economy and Environment Program for Southeast Asia (EEP-SEA), Singapore

Sathirathai, S. and Barbier, E.B. 2001. Valuing mangrove conservation in Southern Thailand. *Contemporary Economic Policy* 19: 109-122

Scottish Executive. 2003. *A Strategic Framework for Scottish Aquaculture*. Scottish Executive Rural Affairs Department, Edinburgh.

Wattage, P. and Mardle, S. 2005. Stakeholder preferences towards conservation versus development for a wetland in Sri Lanka. *Journal of Environmental Management* 77: 122 – 132

Wattage, P. and Mardle, S. 2006. Valuing wetland resources using the analytic hierarchy process. Pp 205 – 218 In: Herath, G. and Prato, T. *Using Multi-Criteria Decision Analysis in Natural Resource Management*. Ashgate: Aldershot, U.K.

Whitmarsh, D. and Wattage, P. 2006. Public attitudes towards the environmental impact of salmon aquaculture in Scotland. *European Environment* 16(2): 108 – 121

World Bank 2006. *Aquaculture: Changing the Face of the Waters. Meeting the Promise and Challenge of Sustainable Aquaculture*. Report 36622 – GLB

Figure 1: Hierarchy of objectives for Scottish salmon aquaculture

Goal	Objectives	Criteria
Maximise net benefits from aquaculture	Maximise socio-economic benefits	Sustaining employment and livelihoods
		Enhancing edible supplies of fish
		Contributing to national tax revenue
	Minimise environmental damage	Minimising pollution and water quality impacts
		Minimising visual intrusion and landscape impacts
		Minimising impact on wild salmon stocks

Figure 2: The AHP paired comparison scale

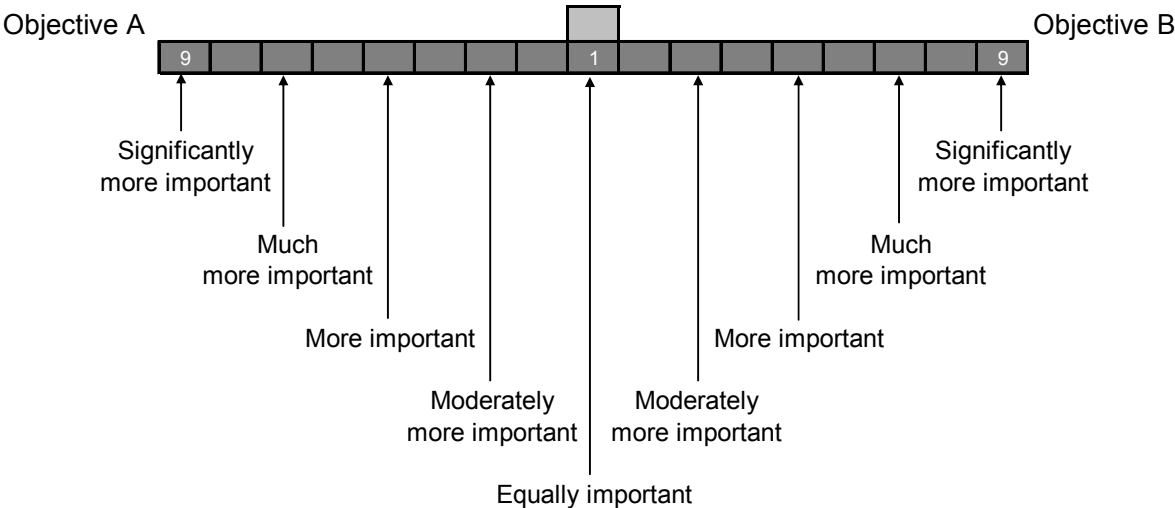


Figure 3: Complete set of pairwise choices used in the survey

	Paired comparison		
Objectives	Socio-economic	<i>Compared with:</i>	Environmental
Socio-economic	Employment etc.	<i>Compared with:</i>	Fish supply
	Employment etc.	<i>Compared with:</i>	Tax revenue
	Fish supply	<i>Compared with:</i>	Tax revenue
Environmental	Pollution etc.	<i>Compared with:</i>	Visual intrusion
	Pollution etc.	<i>Compared with:</i>	Impact on wild stocks
	Visual intrusion	<i>Compared with:</i>	Impact on wild stocks

Figure 4: Structure of the questionnaires used in the public and stakeholder surveys

Section	Public	Stakeholders
Introduction: Summary of the effects of salmon farming	√	√
AHP section: pairwise choices of objectives and criteria	√	√
Preferences towards salmon farming development in Scotland	√	X
Attribute variables: socio-economic information about respondents	√	X
General comments	√	√

Figure 5: Cross tabulation and χ^2 test of the relationship between region and preferences towards aquaculture development (SPSS output)

Preferences towards aquaculture development * Region Crosstabulation

			Region					Total
			A&B	H	O	S	WI	
Preferences towards aquaculture development	Expand	Count	45	31	30	33	50	189
		Expected Count	40.1	38.1	38.3	39.3	33.2	189.0
	Contract	Count	21	27	19	20	20	107
		Expected Count	22.7	21.5	21.7	22.3	18.8	107.0
	NK or nil	Count	16	29	34	27	22	128
		Expected Count	27.1	25.8	25.9	26.6	22.5	128.0
	same	Count	76	63	68	75	39	321
		Expected Count	68.1	64.6	65.1	66.8	56.4	321.0
	Total	Count	158	150	151	155	131	745
		Expected Count	158.0	150.0	151.0	155.0	131.0	745.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.330 ^a	12	.002
Likelihood Ratio	30.522	12	.002
N of Valid Cases	745		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.81.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.202	.002
	Cramer's V	.116	.002
N of Valid Cases		745	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Figure 6: Ordinal logistic regression results

SPSS output

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[SIZERESPONSE = 1.00	-1.880	.346	29.537	1	.000	-2.558	-1.202
	[SIZERESPONSE = 2.00	1.145	.340	11.369	1	.001	.479	1.811
Location	GENDER	-.455	.156	8.527	1	.003	-.761	-.150
	SALWORK	.881	.444	3.931	1	.047	.010	1.752
	ENVORG	-.513	.206	6.230	1	.013	-.916	-.110
	BUYMONTH	.550	.171	10.295	1	.001	.214	.886
	BUYWEEK	1.158	.231	25.144	1	.000	.705	1.610
	SELFEMPL	-.528	.220	5.755	1	.016	-.960	-.097
	FAMSIZE	.174	.059	8.594	1	.003	.058	.290
	DEPRIV	-.091	.045	4.077	1	.043	-.179	-.003

Link function: Logit.

Definition of variables

Variable name	Description	Measurement
SIZERESPONSE	Preference for aquaculture development	1 = decline, 2 = same, 3 = expand
GENDER	Gender	0 for male, 1 for female
SALWORK	Employed in salmon farming or a related industry	0 for no, 1 for yes
ENVORG	Member of environmental group	0 for no, 1 for yes
BUYMONTH	Salmon purchased monthly	0 for no, 1 for yes
BUYWEEK	Salmon purchased weekly	0 for no, 1 for yes
SELFEMP	Self-employed status	0 for no, 1 for yes
FAMSIZE	Size of family	Number of adults and children
DEPRIV	Scottish Index of Multiple Deprivation	Scale based on area decile (1 = most deprived, 10 = least deprived)

Table 1: Summary profile of Scottish regions covered in the public attitude survey

Measure	Units	Argyll & Bute	Highland	Orkney	Shetland	W.Isles	Scotland
Total population	No.	90,900	213,600	19,600	22,000	26,400	5,094,800
Area	Hectare	694,277	2,572,222	98,881	143,836	299,886	7,799,170
Population density	No. per Ha.	13.1	8.3	19.8	15.3	8.8	65.3
Unemployment	%	4.3	4.1	3.0	3.6	5.0	5.5
Benefit claimants	%	13.9	14.5	11.2	10.4	16.1	17.1
Jobs density	ratio	0.88	0.9	0.99	1.17	0.84	0.84
Earnings by residence	£ per week	419.7	395.6	387.3	399.4	402.7	431.4

Notes: Data for total population, area, population density and jobs density are for the year 2005. Unemployment data are for the period July 2005 to June 2006. Earnings data are for the year 2006.

Source: Scottish Neighbourhood Statistics; NOMIS

Table 2: Relative importance of all socio-economic and environmental impacts – Public attitudes

	Criterion priority weight overall (%)				
	Argyll & Bute	Highland	Orkney	Shetland	W. Isles
Employment etc.	23.1	21.6	24.7	27.1	31.3
Fish supplies	14.1	12.5	13.3	13.5	15.0
Tax contribution	4.2	4.0	4.1	4.4	5.3
Pollution	28.8	26.0	26.9	28.3	21.7
Visual intrusion	7.0	7.0	7.4	8.0	5.1
Wild salmon	22.9	29.0	23.5	18.7	21.5
Total	100	100	100	100	100

Table 4: Preferences towards aquaculture development

	Argyll & Bute	Highlands	Orkney	Shetland	W. Isles
<i>Best option for Scotland:</i>	%	%	%	%	%
Expansion	28	21	20	21	38
Same size	48	42	45	48	30
Contraction	13	18	13	13	15
N/K	9	15	19	15	13
Nil reply	1	4	4	3	4
Total %	100	100	100	100	100
Total No.	<i>N = 158</i>	<i>N = 150</i>	<i>N = 151</i>	<i>N = 155</i>	<i>N = 131</i>

Table 5: Objective priority weights and attitude to aquaculture development

Region	Expansion		Same size		Contraction	
	SOCIO weight	ENVL weight	SOCIO weight	ENVL weight	SOCIO weight	ENVL weight
	%	%	%	%	%	%
Argyll & Bute	61.8	38.2	37.2	62.8	20.0	80.0
Highland	62.1	37.9	42.4	57.6	18.6	81.4
Orkney	55.7	44.3	43.1	56.9	20.8	79.2
Shetland	67.6	32.4	44.2	55.8	31.9	68.1
W. Isles	70.1	29.9	52.4	47.6	15.6	84.4