REPORT TO

THE SCOTTISH GOVERNMENT

DETAILED INVESTIGATION OF A RANGE OF ISSUES TO ASSESS THE COST STRUCTURE AND COMPETITIVENESS OF THE SALMON GROWING INDUSTRY IN SCOTLAND

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BY

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ACRONYMS

CAR	Controlled Activity Regulations, Scotland
COP	Cost of Production
DEFRA	Department of the Environment and Rural Affairs, UK
DF	Directorate of Fisheries, Norway
EEA	European Economic Area
EIA	Environmental Impact Assessment
EMS	Environmental Management System
FAO	United Nations Food and Agriculture Organisation
FCR	Food Conversion Ratio
FOB	'Free on Board' or 'Freight on Board' (in this context refers to the exclusion of associated shipping costs or tariffs)
GBP	Great British Pound (£)
MFCA	Ministry of Fisheries and Coastal Affairs, Norway.
MSB	Maximum Standing Biomass
NOK	Norwegian Krone
NPV	Net Present Value
SEPA	Scottish Environment Protection Agency
VMD	Veterinary Medicines Directorate, UK
WFD	Water Framework Directive, EU

EXECUTIVE SUMMARY

This report sets out the findings of a study exploring the regulatory costs and resulting competitiveness of the Scottish Salmon farming industry in relation to producers in Norway and Chile.

A large number of variables define the cost of production (COP), which complicates the task of developing accurate and truly comparable estimates. The study focused on identifying regulatory structures and their associated costs for Scotland and its key competitors, Norway and Chile. The information presented results from detailed consultation with industry and regulators in the three countries, supported by quantitative primary research and financial modelling.

DIRECT COST OF REGULATION

The direct costs of regulation (including all user charges applied to production) amount to 5.6p/kg for Norway, 3.7p/kg for Scotland and 0.9p/kg for Chile. Of the regulatory costs identified, user charges amount to 80% of regulatory costs for Norwegian producers and 47% of regulatory costs for Scottish producers. No similar user charge is identified for Chile.

Purchase of the Norwegian production licence represents a significant start-up cost (over £400,000 per licence with an average farm holding 5 licences). Based on a 10 year return period the licence amounts to 4.5p/kg on the cost of actual production. However only production licences issued after 2001 were subject to this charge, therefore these costs on production would not apply to established farms.

Norwegian operators have in effect enjoyed an "asset windfall" in terms of the tradable value of their existing licences. An alternative approach to converting this to a per kg cost would therefore be to assume that the value of the asset (licence) is maintained, and to use the opportunity cost of the sunk capital – in other words the annual interest. On a licence cost of £400,000, and assuming an interest rate of 6%, this would amount to £24,000p.a. or roughly 3p/kg. On this basis, for most Norwegian salmon producers the annual direct costs of regulation on a per kilo basis are very similar to those found in Scotland, although those costs are applied in very different ways.

Other than the cost of the production licence (representing approx 80% of all regulatory costs identified for the average farm site), Norwegian regulatory costs are minimal. A different approach to regulation is evident in Norway with a greater focus on industry self-regulation. Many of the regulatory costs have been "internalised" through audited internal management systems. This report has sought to separate these out from other routine operational costs, but the result may be a comparative underestimate of Norwegian regulatory costs. Additionally, compared to their Scottish counterparts, Norwegian producers consider more of the costs identified as operational costs for farm sites applying good practice rather than resulting from regulation.

For Scottish producers, other than 47% to user charges, environmental costs are the most significant direct regulatory cost accounting for 40% of the UK's direct regulatory costs, mainly related to:

- charges made by SEPA relating to monitoring and assessment;
- third party and in-house surveys and monitoring; and
- costs associated with mortalities disposal.

Norway has less complex environmental monitoring and reporting requirements, and farmers are not charged directly by the Directorate of Fisheries for supplementary survey and performance review. Chile has a system similar to that of Scotland, but costs are lower.

Stricter environmental controls are required to comply with EC directives such as the Water Framework Directive (WFD) and these may well be necessary in Scotland due to the more sensitive nature of some sites. It is also currently unknown whether this regulatory control may to some extent make a positive contribution to the price premium achieved by Scottish salmon.

INDIRECT COSTS ASSOCIATED WITH REGULATION

The indirect influence of regulation on production costs is more significant than direct regulatory costs.

In the period of review Scottish producers exhibited substantially higher spending on **medicines** – amounting to between 2.5 and 4.5p/kg higher than either Norway or Chile. This difference may be attributable to four possible factors:

- More limited access to newer, more effective medicines or suites of medicines*;
- Higher incidence of sealice (due to environmental/geographic conditions) and therefore higher levels of use of medicines;
- Repetitive use of licensed medicines making these less effective; and
- Higher unit costs of medicines related to quantities and/or logistics;

*Important medicine licensing issues have been resolved in 2008 with all current active ingredients being available in Norway and in Scotland.

In addition to an increased spend on medicines, further costs are associated with a sub-optimal medical regime through comparatively poorer performance/growth rate of stock. These higher costs must, however, be considered against the wider risks associated with reducing licensing requirements in the UK and any benefits, such as the price premium, derived from a strict licensing system.

Feed costs are higher in Scotland than Norway and Chile. There are no regulatory cost contributing to these higher feed costs; these are mainly due to a higher unit price for feed in Scotland. The unit price differences result from the logistical possibilities in Norway and Chile (feed barge access) and economies of scale, but most importantly from the different feed formulations used in Scotland to ensure that UK buyer requirements are met.

The cost of **smolt** is also substantially higher in Scotland than in Norway or Chile. This study did not address production costs of smolt and is unable to offer a full explanation of these differences, however, the most significant factor in comparative smolt price between the countries is expected to be scale of operation. Environmental regulation of smolt production has increased under the provisions of the WFD, and significant charges are now levied by SEPA on smolt producers, but these only explain a relatively small proportion of the differences in price.

The average **farm sizes** reported in the survey of 1,250t annual production for Scotland, 2,880t for Norway and 4,442t for Chile illustrate that the Scottish sector has been unable to exploit similar economies of scale. An obvious constraint here is the restriction in Scotland of discharge consent (CAR licence) to a maximum of 2,500t allowable biomass (equivalent to around 2,000t potential annual production). The uncertainty surrounding approval for

licence variations may also be a factor. However, the nature of available sites in Scotland – often rather shallow if adequately sheltered and accessible – remains a key factor constraining the size of individual farm sites. Some companies do, however, benefit from the 'high value, low volume' image in the price premium enjoyed by Scottish product.

USER CHARGES

The user charge (the Norwegian licence and the Crown Estate rent in Scotland) is a significant cost to the sector in both these countries. In Chile a user charge related to production is not evident.

Scottish rent is charged at around 1.6p/kg of harvested salmon with producers charges based on actual production. Purchase of the Norwegian production licence represents a major start-up cost (over £400,000 per licence, allowing for maximum standing biomass of 780-900 tonnes depending on locality). Based on a 10 year return period the licence amounts to 4.5p/kg on the cost of actual production. However only production licences issued after 2001 were subject to this charge, therefore these costs to production would not apply to established farms.

Depending on the assumptions made, it can be taken to correspond to a cost of between 2.6 and 4.5p/kg, and as such is higher than the Scottish user charge.

There are pros and cons for the differing approaches adopted by Norway and Scotland in applying a user charge. The Norwegian licence fee may serve as a barrier to entry for small firms. On the other hand, as a tradeable permit, it provides for both security (of production) and flexibility (to sell/rationalise). It may also be used to raise finance (at least during a positive business cycle). The Scottish system on the other hand is less expensive and less of a barrier to entry. The licences held by Scottish producers (planning and CAR) certainly contribute to the value of the company, but inevitably to a less extent than Norwegian production licences.

THE PLANNING AND MANAGEMENT CONTEXT

The costs associated with site identification and planning permission/permitting procedures were broadly similar between countries and did not amount to a major "cost/kg". Several recent developments implemented by SEPA have streamlined the environmental regulation of fish farming in Scotland and research has been commissioned to support a more proactive approach to aquaculture planning. For now, however, uncertainty remains a constraint to aquaculture development in Scotland.

In Norway, the periodic issue of production licences sends a clear and simple message: *we wish to expand steadily and sustainably*. Although there may still be uncertainties associated with specific sites there is a general presumption that development will take place. This contrasts with Scotland where there is no such presumption, and there is often a negative reaction to further development, especially amongst the local population. There is a real need to create a more positive development and investment climate if the Scottish industry is to expand sustainably.

FURTHER WORK

Further work proposed includes:

- Cost-benefit analysis of environmental regulatory requirements, assessing the charges and services associated with the aquaculture sector, including in relation to other relevant sectors. Review alternative approaches to environmental management of the Scottish sector, including the use of a system-based assessment of environmental capacity and a higher degree of self-regulation.
- Review of the veterinary medicine licensing regimes in Norway and Scotland. While medicine licensing is not a devolved matter and compliance with the necessary EC directives must be maintained, efficiencies in the UK licensing process could be identified. This would better ensure the Scottish industry is not comparatively disadvantaged as new medicines are introduced. Identifying the various safeguards in place for Scottish production may also result in improved market/buyer recognition.
- An assimilative capacity model has recently been developed. This model should be integrated into a more pro-active approach to aquaculture planning in Scotland; ensuring environmental capacity is a criteria in the sustainable development of the aquaculture sector.
- Investigate the market constraints on the Scottish industry, in particular the costs and benefits of enabling increased farm size.

OVERALL

If both direct regulatory costs and user charges are taken into account, Norway shows a higher regulatory cost than Scotland. The differences in regulatory costs are relatively small, and furthermore represent only a small proportion of the overall differences in costs of production between the countries. The differences in the delivered cost of feed and smolt are far greater. Chile undoubtedly has lower overall costs (in particular due to lacking a production-based user charge) but there are moves to tighten the regulatory framework and increased costs are likely.

The Norwegian licence fee appears to in part serve to fund the environmental management of the industry in the same way as the SEPA charges in Scotland do on an ongoing basis. While the state sale of licences after 2001 has provided Directorate of Fisheries revenue, many companies with licences before 2001 continue to benefit from this environmental management of the sector by the state without having made the investment upfront via a licence fee.

For Scottish producers the indirect costs associated with the regulation of medicines and limits on farm size are higher than direct regulatory costs, but these are a result of conforming to EC requirements and to some extent they may be a necessary consequence of the sensitivities of the Scottish environment and its stakeholders.

The modern consumer wishes to be assured of a well regulated and environmentally friendly industry, and it would appear that it is prepared to pay the few pence/kg required for this. Indeed, it is arguable that the "Scottish premium" which is evident in consistently higher average prices for Scottish product compared to production elsewhere, is partly dependent upon such re-assurance, and it may be possible to better exploit the comprehensive regulatory regime as a marketing tool.

Nevertheless, UK regulatory costs should be kept to the minimum, and lessons may be learned from the somewhat simpler and more internalised environmental monitoring and reporting regime being implemented in Norway.

1 INTRODUCTION

1.1 BACKGROUND

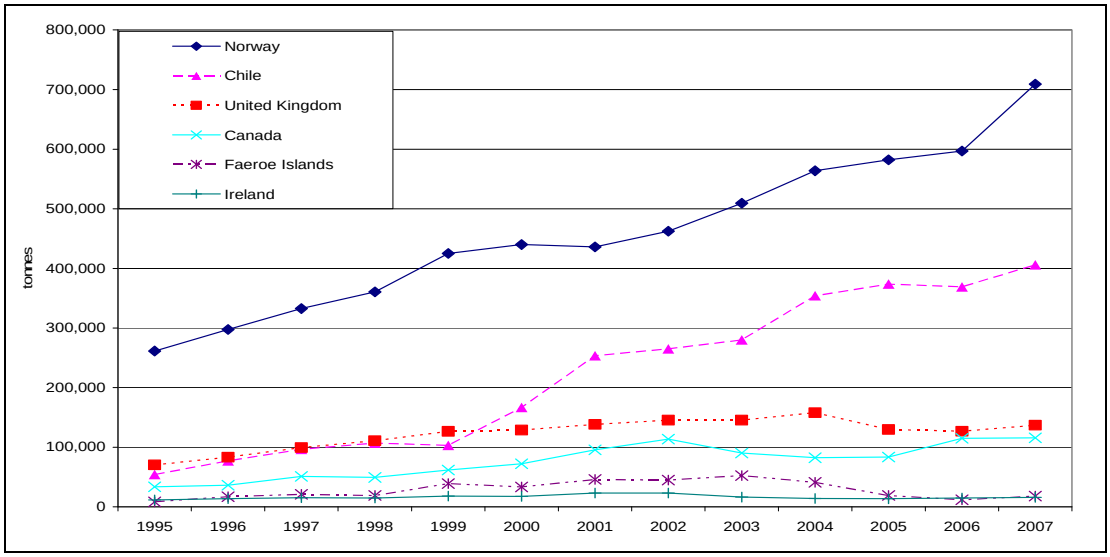
The Scottish Government commissioned Poseidon ARM Ltd. in association with Hambrey Consulting Ltd. to undertake "a detailed investigation of a range of issues to assess the cost structure and competitiveness of the salmon growing industry in Scotland". This report sets out the detailed findings of the study.

1.2 THE GLOBAL CONTEXT

Atlantic salmon production has increased at a rate of around 15% per year since 1994. By 2003 it accounted for 35% of aquaculture output by Western European countries (Rana, 2007). Estimates for 2007 production of Atlantic salmon are over 1,400,000 tonnes: Norway 709,000 (49% of global Atlantic salmon production); Chile 406,000t (28%), United Kingdom (Scotland)[1] 137,000t (10%); and Canada 116,000t (8%).

Figure 1 shows production trends since 1995, illustrating the growing dominance of Norway and Chile in global production terms. These two countries are seen to be producing broadly similar quantities of salmonids when Coho salmon and trout are taken into account although lice and disease outbreaks including ISA have caused Chilean Atlantic salmon production to stall in recent years.

Figure 1: Production of farmed Atlantic salmon by producing country 1995-2007 (tonnes)



Source: FAO 1995-2005, Kontali 2006-2007 (estimate)

Table 1 illustrates that between 2001 and 2005 only Norway and Chile have continued to grow while all other countries' production has declined to varying degrees. Production in the UK showed a 6% decline between 2001 and 2005, but this is less significant than the 41% decline in Irish production, which had showed a similar growth level to the UK in the preceding 5 year period.

[1] In the UK, the production of Atlantic salmon occurs almost exclusively in Scotland, with just a small amount of smolt production occurring in England.

Table 1: Production growth rates by major producing countries, selected periods

	1995-2001	2001-2005	1995-2005*
Norway	67%	33%	123%
Chile	300%	22%	386%
UK	97%	-6%	85%
Canada	148%	-7%	132%
Faroes	439%	-59%	122%
Ireland	97%	-41%	17%

Source: FAO

*note: the 10 year growth rate in column 3 is a direct proportional comparison of 1995 and 2005 totals and therefore will not equal the sum of columns 1 and 2

More recently, the disease outbreaks in Chile have resulted in a more modest 7% growth in volume and 2% value growth in 2007 (Intrafish, 2008), which is much lower than the double digit growth seen in the preceding four years. In 2007 Scotland and Norway both saw larger production growth where improved prices have encouraged substantial production increases. Norwegian salmon exports grew by 18% in 2007. Scottish production in 2007 was estimated to be 8% by volume up on 2006 levels at 142,566 tonnes (FRS, 2007).

Despite the consolidation seen in the Scottish salmon farming sector over the past 10 years, it is a key economic sector and continues to be of socio-economic importance, particularly to the Highlands and Islands region. This prompted the Scottish Government to produce a Strategic Framework for Scottish Aquaculture in 2003. It was recognised that to understand how the Scottish industry can remain globally competitive, the cost of production (COP) between the main producer countries needs to be better understood.

There are a large number of variables at play in defining the COP, which complicates the task of developing accurate and truly comparable estimates. A presentation of research by Trygve Berg Lea of Skretting provided a COP comparison between Norway, Chile, Scotland and Canada (Skretting, 2006). This looked at key inputs such as smolt and feed and differences in environmental conditions. Lea concluded that "Chile has the lowest cost of production of goods released from stock. This is mainly due to favourable environmental conditions giving a shorter production time and lower labour costs. But the differences in cost of production of goods released from stock are not critical when comparing with costs later in the supply chain (processing and freight to market)". This latter aspect is increasingly important as higher fuel costs raise the cost of transport and places Scotland in a favourable competitive position with its relative proximity to its key market; the UK and other EC countries.

The salmon sector has seen substantial consolidation over the last decade, but remains highly competitive. There is constant pressure to further reduce the costs of production. Although these now tend to be small incremental gains, they are essential for operations to remain competitive while increasing in scale.

The dominance of multi-national companies in the sector can often blur issues that are defined by national boundaries. The continued economic and social importance of the industry does, however, maintain a national interest in its international competitiveness and an incentive to ensure Scotland remains an attractive location for salmon companies. A key aspect in maintaining or improving Scotland's competitive position is a regulatory climate that promotes industry confidence and supports investments made. This regulatory climate also contributes to consumer confidence in the Scottish product, helping to maintain a substantial price premium over other producer countries. It is here that the public sector can have some level of influence

over the strategic decision-making of companies that are for the most part influenced by international commodity prices and market forces.

Aquaculture legislation in the UK has for the most part developed on a piece-meal and reactive basis in response to a highly dynamic new production sector that continues to innovate and strive for growth. An increasingly complex array of regulation became established for a sector that was for a long time viewed as a hybrid of fishing and agriculture rather than a sector in its own right. The UK and Scottish Governments have made a number of amendments to ensure the aquaculture sector operates under a more effective and supportive regulatory regime. This study will inform the ongoing development of that regime by identifying Scotland's comparative position in 2008 in terms of regulatory cost for salmon production.

1.3 STUDY OBJECTIVES

This study has focused on identifying regulatory structures and associated costs through detailed consultation with both industry and statutory regulatory bodies, supported by quantitative primary research and financial modelling. The scope of works required resources to be focused on Scotland's key competitors, Norway and Chile.

In order to provide a comparable study with sufficient detail, consultations were undertaken by team members based in Scotland, Chile and Norway. This provided a detailed understanding of the complexity of the regulatory systems in the 3 competitor countries and the cost implications (both direct and indirect) that this places on overall production.

In all 3 countries the emphasis has been on those regulations which directly impact upon the farm production of salmon – i.e. to the point of 'farm gate'. No attempt has been made to quantify the costs associated with harvesting, processing or marketing the product.

It should also be recognised that in line with the overall objective of this work on comparative costs, quantification is confined to the cost of regulation. Although the report will qualitatively discuss the comparative benefits derived from regulation, this research is not a cost benefit analysis. More research would be required in order to undertake such analysis. First, a detailed market investigation would be required to identify how the price premium associated with the Scottish product is determined. Second, the relationship between various costs and benefits must be better understood.

As a member of the European Community, the UK is required to implement various EC directives that may have an impact on the cost of regulation. Some, but not, all of these will apply to Norway as part of the European Economic Area, while fewer still will apply to Chile. Therefore while this research will identify areas where there are differences in costs, compliance with legislation may limit the extent to which regulatory changes are possible.

Despite the inevitable limitations of this investigation into comparative regulatory costs, presenting directly comparable economic information for the three main competitor countries provides a valuable resource to regulators to inform further discussions on developments in the regulatory regime in Scotland.

1.4 STRUCTURE OF REPORT

The report provides an outline of the methodology that has been used to inform the report (section 2). This also highlights where any assumptions have been made in order to overcome the complexities of data comparability.

The costs and nature of regulation encountered in each country is then explored briefly in turn – Scotland, followed by Norway and finally Chile (sections 3, 4 & 5).

Comparative analysis of the country information (both quantitative and qualitative) is presented in section 6 of the report.

Section 7 uses the findings of the consultation exercise to assess the patterns of development that have shaped the development of the Atlantic salmon farming business in the 3 countries. It outlines the strategic implications for the Scottish industry of the study findings, and discusses the implications of these for future industry development, including both the comparative advantages and disadvantages of the current regulatory system in Scotland.

2 METHODOLOGY

2.1 APPROACH

A comparative study of the costs of complying with the differing regulatory frameworks of each of the three producing countries (i.e. Scotland, Norway and Chile) was undertaken. To ensure an objective, in-depth and up-to-date review, independent Norwegian and Chilean aquaculture experts undertook the review of these countries. Each in-country expert was required to deliver 3 outputs:

1. Update of the regulatory comparison supplied by the client (see Appendix A);
2. Completion of farm interview *pro forma* (see section 2.4 below); and
3. Production of a country report describing the regulatory regime and discussing associated issues (see sections 3, 4 & 5).

The information obtained through review and face to face consultation was analysed using financial models for each country; one reflecting a single site fish farm, and one reflecting a multiple site operation. These models reflect, as closely as possible, the costs and revenues currently prevalent in the market. The study examines the impact on the financial models of applying the regulations found in the three producing areas which enables strategic implications of the differences imposed as a result of regulation to be determined.

2.2 REVIEW OF EXISTING MATERIAL

Prior to commencing the consultation a thorough review of background material was undertaken. This included a review of the stage 1 report of this project, along with:

- www.intrafish.com (various reports and yearly data);
- Kontali Analyse (various reports and yearly data);
- www.globefish.org (the unit in the FAO Fisheries Department responsible for information on international fish trade);
- Industry associations (SSPO);
- A wide variety of published and grey literature.

Additionally the regulatory comparison that was provided by the Scottish Government at the start of the project was reviewed and updated to ensure a sound platform for subsequent consultation. This was carried out by our in-country team members to ensure a sound basis for subsequent quantitative analysis as the first step in the assessment (see appendix A).

2.3 MODEL DEVELOPMENT AND INFORMATION REQUIREMENTS

A simple financial model was developed in Excel presenting the impact of all regulatory costs from farm establishment to production output. The model builds further upon and enhances an input-output model which was developed by members of the team for the Scottish Salmon Producers Organisation (SSPO) in a study investigating the impacts of scale on production costs.

To enable a comparison between countries and various scales of operation, a common unit was established for all results, namely **£ per kg**. This related to whole live weight not gutted weight as production volumes were reported in live weight and only pre-harvest costs were to be considered.

Average production site sizes were recorded and average currency exchange rates were determined for the periods under consideration (2006/2007) using historic exchange rates reported at www.xe.com.

A standard 10 year return period was set in order to incorporate capital costs on an annual basis. This standardisation was necessary as companies were found to use differing return periods for the same capital items. Varying depreciation rates were also reported, resulting in the decision not to apply depreciation to capital items for the purposes of this comparative study.

Determining the specific production cost categories to be used in the model is complicated by the different accounting structures used in different countries, with large differences in company cost centres even within the same country. Additional thought was also required in the design of the economic model in order to capture all the different variations of regulatory costs that occur in each country. The resulting economic model pro-forma included all possible areas of cost, meaning that not all input values were applicable to all countries or all companies.

The focus of both the model and the consultations was the costs of regulation (both direct and indirect)..

The cost categories used in the economic model are:

- Planning – site identification, Registration, EIA, Licence to discharge;
- Capital costs – fish containment, feeding / grading equipment, vehicles / vessels, storage, services, buildings;
- Raw materials – smolt, feed;
- Staffing – wages, worker welfare, safety / training;
- Environmental – waste, pollution prevention, monitoring ;
- Disease / food safety – Medicines, Chemical testing, Vet fees, fish movement, other disease management costs;
- General Operation – rent / licensing, Insurance;

For all costs categories the following data and information were sought:

- Direct Costs – single, annual, levy, payments to 3rd parties;
- In-house costs – staff costs associated with addressing regulatory issues;
- Supporting information - applicable regulation and regulator, timing, scale issues.

The model also includes space for any additional costs to be added as appropriate for each company interviewed without compromising the model calculations. This provided the model with the flexibility to fully capture the difference in both regulation and accounting that exist between countries and between companies.

The model also enables any associated off-setting cost reductions or improvements in competitiveness due to the regulations to be identified e.g. reduced insurance costs. This analysis was undertaken for both single and multiple site producers in order to assess whether the financial impact of regulation varies with the scale of operation.

2.4 REGULATORY COST DETERMINATION

Following model development, the specific information requirements were defined and a **pro forma farm interview sheet** (Figure 2) was developed for collation within a spreadsheet to ensure consistency in approach and reporting across the 3 countries. The Steering Group

approved the scope and format of the proposed information and data gathering. The in-country experts then used the pro forma reporting and spreadsheet structure to undertake structured consultation.

Where possible direct and face to face consultation was undertaken with the industry in all 3 countries. Consultants gathered information within the pro forma (linked to the data requirements of the economic model) giving assurance of individual company confidentiality. To ensure comparability, consistency of approach and to further establish context, each respondent was then asked the following questions:

1. Have any of the regulatory costs changed significantly in the last 2-3 years, and if so please provide details
2. What was the total production in tonnes for the year for which data is provided below
3. Were there any unusual factors during this year which meant that regulatory costs were higher than might normally be expected. If so, provide details on which ones and cost implications compared to usual costs;
4. Were there any unusual factors during this year which meant that other production costs were higher than might normally be expected. If so, provide details on which ones and cost implications compared to usual costs
5. How many locations does the farm have
6. Insert below a description of all other implications for regulatory compliance that is not fully captured above
7. Would any of the regulatory costs stated be incurred anyway in the absence of any regulation, purely on the basis that they might in any case make good business sense? If so please specify and provide details

Consultations also allowed more informal discussion of industry development and perceptions of relative advantage of different producer countries. Where useful and necessary, this industry consultation was supported and in some cases corroborated by consultation with statutory regulators. This has enabled a far more detailed and comparable dataset (and supporting anecdotal evidence) to be obtained than would be available through publicly available data sources.

In all cases, the industry was asked to distinguish the direct and indirect costs attributable to regulation. Additional costs incurred due to buyer requirements were excluded from the regulatory costs category.

Emerging regulation was excluded from the model as charging levels could not accurately be predicted, but the scale of expected impact is reported.

Figure 2 Example farm interview pro forma (costs in £)

					Direct Regulatory Costs								***In-house***		***Timing***	***Scale Issues***
					Single fixed payment		Annual cost		Production Levy		Payment to third parties		Staff days		Length of process	(Answer a) location or b) company)
		Cost of production (annual)	Applicable regulation(s)	Regulatory body	value	unit	value	unit	value	unit	value	unit	value	unit	av # months	
1	**Planning**															
1a	Site Identification															
1b	Registration															
1c	Planning / EIA															
1d	Licence to discharge															
1e	Other (specify)															
	CAPITAL COSTS															
2	**Buildings & Equipment**															
2a	fish containment															
2b	feeding/grading equipment															
2c	vehicles/vessels															
2d	Storage (fuel / oil etc)															
2e	services (elec/water)															
2f	buildings															
2g	Other (specify)															
	OPERATING COSTS															
3	**Raw materials**															
3a	smolt															
3b	feed															
3c	Other (specify)															
4	**Staffing**															
4a	wages															
4b	worker wefare															
4c	Safety compliance/training															
4d	Other (specify)															
5	**Environmental**															

5a	Waste / wastewater															
5b	Pollution Prevention															
5c	Routine monitoring															
5e	Other (specify)															
6	**Disease/Food Safety**															
6a	Medicines/treatments															
6b	Chemicals or pathogens testing															
6c	Vet fees															
6d	Fish movement															
6e	other disease management costs															
6f	Other (specify)															
7	**General operation / other**															
7a	Rent/licensing															
7b	Insurance															
7c	Other (specify)															
	TOTAL															

Insert below a description of all other implications for regulatory compliance that is not fully captured above

eg. strategic direction, constraints on sector development, attitude, compliance

2.5 COMPARATIVE REVIEW

The country spreadsheets were reviewed and the model refined to produce comparable outputs. As each sector contains a variety of business models and is structured differently in terms of production permits, a common unit was identified to enable the international comparison of production costs and associated regulatory costs. That unit is the 'farm site' which is a production unit recognised across all three countries. With the growth and consolidation seen in the industry, most companies now operate more than one farm site, ranging from two to over 30 farm sites. In some cases therefore the surveys yielded costs for an average farm site across a company.

The production volumes were calculated as annual production. This was calculated from either licensed biomass or production cycle figures to determine average harvested production on an annual basis. As the scope is production to farm gate, all figures were based on ungutted live weight.

Comparative analysis has been applied to the outputs from these runs, establishing the scale and type of effect for each impact category, i.e. x% of total regulatory costs of which y% are direct costs and z% are additional staff costs.

Scale issues were also considered within each country, both in terms of scale of farm site and in terms of company size. The surveys ensured coverage of both large companies and SMEs operating in the sector to identify scale issues at a company level. For each country costs associated with average, small and large farm sites were calculated.. Quantitative analysis was undertaken in relation to farm size, while company size was considered qualitatively.

3 REGULATION IN SCOTLAND – NATURE AND COSTS

3.1 REGULATORY COSTS

Table 2 Regulatory costs (£) for an average salmon farm in Scotland per annum*

		Average site (1,125t)			Large site (1,333t)			Small site (400t)		
		annual cost per site	£ per Kg	% of reg. costs	annual cost per site	£ per Kg	% of reg. costs	annual cost per site	£ per Kg	% of reg costs
1	Planning	2,367	0.003	8%	2,405	0.0018	5%	2,250	0.0056	13%
1a	Site Identification									
1b	Registration									
1c	Planning / EIA	2,103	0.003	7%	2,137	0.0016	5%	2,000	0.0050	11%
1d	Licence to discharge	264	0.000	1%	268	0.0002	1%	250	0.0006	1%
	CAPITAL COSTS									
2	Buildings & Equipment	760	0.002	3%	525	0.0004	1%	1,049	0.0026	6%
2a	fish containment									
2b	feeding/grading equipment									
2c	vehicles/vessels									
2d	Storage (fuel / oil etc)	341	0.001	2%	175	0.0001	0%	841	0.0021	5%
2e	services (elec/water)									
2f	buildings									
2g	navigational marks	315	0.000	1%	350	0.0003	1%	208	0.0005	1%
	OPERATING COSTS									
3	Raw materials	-	0.000	0%		0.0000	0%		0.0000	0%
3a	smolt									
3b	feed									
4	Staffing	677	0.001	1%	833	0.0006	2%	208	0.0005	1%
4a	wages									
4b	worker welfare									
4c	Safety training	542	0.001	1%	667	0.0005	1%	167	0.0004	1%
4d	VHF /boat handling	135	0.000	0%	167	0.0001	0%	42	0.0001	0%
5	Environmental	14,828	0.016	39%	17,507	0.0131	38%	6,790	0.0170	38%
5a	Waste / wastewater	4,538	0.005	12%	5,162	0.0039	11%	2,667	0.0067	15%
5b	Pollution Prevention	15	0.000		15	0.0000	0%	15	0.0000	0%
5c	Routine monitoring	1,528	0.002	5%	1,701	0.0013	4%	1,008	0.0025	6%
5e	slice residue analysis	1,248	0.002	4%	1,187	0.0009	3%	1,433	0.0036	8%
5f	removal of morts	7,498	0.007	18%	9,442	0.0071	21%	1,667	0.0042	9%
6	Disease/Food Safety	889	0.001	2%	1,052	0.0008	2%	400	0.0010	2%
6a	Medicines/treatments									
6b	testing									
6c	Vet fees	889	0.001	2%	1,052	0.0008	2%	400	0.0010	2%
6d	Fish movement									
7	General operation etc.	19,167	0.018	46%	23,704	0.0178	51%	7,111	0.0178	40%
7a	Rent/licensing	19,167	0.018	46%	23,704	0.0178	51%	7,111	0.0178	40%
7b	Insurance									
	TOTAL	38,688	0.040	100%	46,036	0.0345	100%	17,808	0.0445	100%

*Annual production based on 10 year return period

Table 2 above presents a breakdown of the annual regulatory costs for an average salmon farm site of 1,125t based on a 10 year return period, a larger site (1,333t) and a smaller site (400t). It should be noted that the average site size reported in the survey is larger than that derived from

the FRS production survey; based on 157 active sites producing 131,847t the average site across Scotland is 840t. This suggests that even though the survey covered companies of varying scales, relative to the average Scottish site, those surveyed focused production in large sites. The implications of scale are discussed further in section 3.4 below.

Regulatory costs are incurred from site identification, planning and licensing through to operation. These include one-off charges, annual charges, payments to third parties for services (such as EIA or environmental survey) and costs associated with staff time to address regulatory issues.

Under 'general operation' the rent paid is included. This can be viewed as a user charge based on harvested production and is therefore collected once per production cycle. The assumption used is that a site licensed for 1,250t maximum standing biomass (MSB) can yield 2,250t per production cycle, equating to 1,125t per annum.

The estimated annual regulatory costs for an average production site in Scotland amounts to £37,417, which on a £ per kg basis equals £0.038/kg or 3.8 pence. 42% of this cost is the rent paid at an average of 1.6p/kg. Excluding the user charge, regulatory costs decrease to 2.1p/kg.

A further 42% of the regulatory costs result from environmental costs which include SEPA charges and the disposal of mortalities. Disposal of mortalities is included as a regulatory cost as other producer countries permit the re-use of ensiled mortalities (soil treatment) creating revenue that covers costs.

The up-front costs associated with the planning process when considered over a 10 year return period represent only 8% of the regulatory costs identified. This is however assuming the application is successful and does not incur additional costs for addressing objections or enquiries.

3.2 DIRECT EFFECTS ON COST OF PRODUCTION

3.2.1 Planning

Prior to establishing a farm, planning consent must be obtained from the local authority. For large farms (in practice virtually all new farm applications) a full Environmental Impact Assessment (EIA) and environmental statement (ES) is typically required to support a planning application.

Farms are increasingly well informed of the issues that are likely to impact upon applications, and undertake extensive work to propose sites which are likely to succeed. It is good practice for applications to be informed by pre-consultation with statutory authorities and non-statutory consultees. This is not currently a regulatory requirement although this may change. Table 3 presents typical costs associated with the requisite environmental information for a planning application.

Table 3 Typical costs incurred by a company in planning for a salmon production site in Scotland

Collecting hydrographic information:	£3,500
Modelling	£4,500
Wave / Climate analysis	£2,000
Landscape analysis	£3,000
Benthic Survey	£3,500
Video Survey	£7,000
Drafting EIA / ES	£10,000 - £20,000

In practice not all of the above may be required. Additionally these figures will vary between companies, with some able to negotiate favourable fees or able to make a cost saving through undertaking the work in-house. Companies that undertake all EIA work in-house are likely to budget around £12,000 in actual costs over and above the costs associated with staff time.

There is an application fee under the Town and Country Planning (Marine Fish Farming) (Scotland) Order 2007 payable to a Local Authority. The main objective is full cost recovery so the fee levels are being reviewed regularly for all local authorities, although there are not many applications coming through to see if fees are set appropriately. Current costs are £145/0.1ha of surface structures plus £50/0.1ha for additional seabed area used (i.e. for mooring lines etc.).

Planning approval is now granted in perpetuity rather than the 15 years that the Crown Estate lease was for. This has implications for the confidence of the sector, banks and investors in particular enterprises.

3.2.2 Licensing

The main other licence required for the establishment of a fish farm is the Controlled Activities Regulation (CAR) licence (formerly known as the consent to discharge). Whereas the planning application looks at whether or not a farm can be established, the (CAR) licence examines farm detail – size, and how it is to be operated, determining the maximum biomass which can be grown on site. This application is supported by:

- Baseline biological survey (typically outsourced – £2-5,000. Larger companies may save on this figure by taking their own samples then sending them away for benthic analysis);
- Tidal survey;
- Auto DEPOMOD modelling;
- Proposed treatments;
- Fallowing plan;
- Details of feed regime;
- Antifouling proposals.

In practice much of the supporting information for a CAR licence has also been submitted for the planning consent. In addition to the costs associated with collecting the data (detailed under planning application), the main cost is in staff time. Typically, once all the information is available it may be as little as 1 day of staff time to put together the CAR application.

The direct fee for the CAR licence (which in practice all but the smallest units would require) is £2,550. This licence covers all discharge of medicines. Further details of SEPA charging structure is contained at http://www.sepa.org.uk/charging/fees_charges/index.htm

The other licence required at the planning stage is issued by the Maritime and Coastguard Agency (MCA) under the Coast Protection Act 1949 (as amended by S36 of Merchant Shipping Act 1988). This licence approves the location of the farm from the point of view of maritime safety and stipulates the navigational marks which are required.

There is no charge for the CPA licence. There is also an advertising cost associated with both CAR and CPA applications. The applicant must undertake local public advertising, at a negligible cost.

3.2.3 Capital investment

All on-shore facilities such as warehousing, feed storage, and staff accommodation is covered by national building regulations. As these are standard across all sectors and do not specifically relate to aquaculture, the costs of complying with these have not been investigated as part of this

study. Furthermore, no reference was made to these regulations by any of the farmers interviewed – indicating that they are not perceived as a regulatory burden which impacts upon the industries international competitive position.

The main area of fish farming shore based infrastructure which has recently been the focus of updated legislation governs the storage of oil and diesel on site. The Water Environment (Oil Storage) (Scotland) Regulations 2006, require the upgrade of oil storage to bunded single skin or double skin tanks. All companies referred to this recent cost – a one off charge associated with the upgrade of £3 – 5,000 per farm. One company referred to a recent substantial oil spill – indicating that the strengthening of legislation in this area is justified.

Any slipways or piers specifically constructed for the production site would also require the company to apply for a FEPA licence under the Food and Environmental Protection Act 1985 (as amended). However a site using existing piers or slipways would not require this additional cost, which is generally below £10,000 for the collation of information and the licence itself.

Containment standards governing the quality of nets and moorings are provided for within the Aquaculture and Fisheries (Scotland) Act 2007. The exact details of inspection of containment standards has not yet been determined although it is likely to fall to the Fish Health Inspectorate (FHI) of FRS, and will coincide with their fish health inspections. Several farmers indicated that this area was effectively self governing as without effective containment standards, achieving profit is all but impossible – although major escape incidents continue to occur periodically. Containment standards are also included in the industry's code of practice.

Health and safety regulations stipulate that safe working platforms are required which result in the requirement for additional plastic walkways. To fully deck each 100m pen costs in the region of £2,000. A 1,500t farm is likely to have around 10 pens.

Most companies have also moved in recent years toward the introduction of automated feeding systems, typically supplied via a large feed storage barge, or in some case a shore-based silo. No regulations currently govern the standards of feeding systems. Similarly there are no minimum regulatory standards applied to fish grading systems.

As part of the CPA licence (mentioned above), navigational marks of certain types and dimensions must be installed. The exact requirements will be determined as a result of a CPA licence application (detailed above under licensing) and will depend upon the location of the farm, with those closest to busy shipping routes likely to require the most navigational marks. Typically complying with CPA requirements is likely to cost £1,000 to £5,000 per site.

3.2.4 Farm operation

The main raw material costs are for feed and smolt (although the cost of smolt is in turn influenced by the cost of feed). The basic cost of these raw materials is not affected by regulation, with market forces and consumer preferences being the driving factor. However, the cost of smolt is comparatively high in Scotland due to the smaller scale of smolt production, and costs are increasing, in part due to additional charges for impoundment, abstraction and discharge into freshwater as a result of the EU's water framework directive.

Feed costs are also reportedly higher in Scotland than in competitor countries. One of the companies producing smolt in freshwater lochs in the Western Isles quoted an additional cost of £90 / tonne of smolt feed due to a requirement for low phosphorous, which might translate to roughly 1.5p/smolt.

Most of the health and safety requirements now placed upon the farm were seen as sensible. One company referred to the Health and Safety requirement to always have 2 people on all vessels or pens at any one time. This reduced the overall flexibility of work practices and probably means that overall staffing levels are higher – or at least it has become harder to reduce

staffing levels further, in spite of the advent and widespread adoption of automated feeding systems.

Training costs – as a result of regulatory requirements - are an increasingly important component of costs to the industry. Typical training costs are detailed below:

Sea Survival £2,000 / employee

RYA level II boat handling £300 / employee

VHF radio £100 / employee

The above courses are a requirement for all staff that work at sea. Further more specialist training (and qualifications) will also be required for a smaller number of site operatives, these include Boat Masters Certificate (for operating larger landing craft) and the JCB Load-all operators licence. Training costs only amount to a small proportion of staffing costs amounting to a one-off outlay of a few thousand pounds per employee with additional charges for licence renewal every few years.

3.2.5 Environment

Annual Discharge Fees

Once farms are operational they must pay an annual subsistence charge again related to the Water Environment (Controlled Activities) (Scotland) Regulations 2005. This fee effectively covers the cost of routine SEPA inspections. The subsistence charge is a graduated fee, based on scale and operation (i.e. number of drugs licensed).

- Lowest = £144 / yr – in practice rare for Scottish marine fish farms.
- Median = £2,415 / yr – most Scottish marine farms fall in this category.
- Highest = £4,830 / yr – largest farms with most medicines etc.

Freshwater

The enactment of the EU Water Framework Directive has changed the cost structures and regulatory requirements for marine salmon farms (as highlighted above), and has also had a substantial impact on freshwater smolt production – and it is in this area that farmers have referred to the largest increase in regulatory costs (which in turn increase the cost of smolt).

Charges payable to SEPA are applied in relation to impoundment, abstraction and discharges. The exact cost calculation for freshwater environmental charges is complicated depending on factors such as the volume of the abstraction or impoundment and the characteristics of the receiving waters. Annual charges are typically in the range of:

Impoundment £0 – 1,300

Abstraction £0 – 2,500

Discharge £5 – 900.

Additional costs are incurred in some cases where hatchery filtration systems have required upgrading. Similarly where water is taken from a stream flow, monitors are often required estimated to cost around £5,000 per site.

While the above represents a cost increase to smolt producers, it should be recognised that the aquaculture sector is benefiting from special dispensation in terms of permitted discharges (particularly for freshwater lochs) when compared to other production sectors.

Routine Biological Survey

Companies are also required to undertake a full biological survey every 2 years (once per cycle) to provide a routine comparison to the baseline survey (undertaken at the time of the planning application). This will typically cost between £3,000 to £5,000 depending on the level of sampling and analysis done in-house. There is no cost associated with the submission of this information. Where the survey reveals unacceptable impacts SEPA would typically discuss with management issues about husbandry, feed management. In extreme or persistent cases this may trigger a reduction in the permitted biomass or an extended fallow.

Residue Testing

Routine tests must also be carried out to determine the level of environmental residues which remain after sea lice treatments which companies are licensed to discharge under the Water Environment (Controlled Activities) (Scotland) Regulations 2005. Testing normally requires triplicate samples to be taken at 2 locations around the farm following treatment. Farms budget between £500 to £1,000 each time that residue testing is required.

Note: Costs reported in the survey relate to 2006/2007 costs incurred. SEPA has recently reduced its residue sampling requirement to once per production cycle rather than on an annual basis. Therefore the regulatory costs reported for residue testing should have reduced.

Waste

The main waste issues are covered by the Environmental Protection (Duty of Care) Amendment (Scotland) Regulations 1991, but this mainly results in a small administrative cost to ensure that waste is properly disposed of. The Special Waste Regulations 1996 cover disposal of materials such as oil and batteries and require an administrative cost to register consignments plus a £15 per site annual charge to SEPA.

All companies interviewed referred to the cost of disposal of mortalities from farms. This also falls under the Animal By-Products (Scotland) Regulations 2003. The costs of disposal vary depending on the type of mortality – routine or an 'event' mortality – and the location of the farm. A derogation for the Northern Highlands and Islands applies to farms north of Fort William. This enabled one company to dispose of waste on a machair landfill site in the Western Isles for £70/tonne, whereas if on-site ensilage and transportation to an appropriate incineration facility (in NW England) were required, the cost could be as high as £200/tonne. Companies typically budget for 5% mortality.

3.2.6 Disease and food safety

The main governing regulatory requirements result from the EU Directive 91/67 (concerning animal health conditions governing the placement on the market of aquaculture animals and products). This requires the Fish Health Inspectorate (FHI) to inspect all farms once per year (every 2 years for broodstock) to inspect fish health and welfare. Cost to the industry is estimated at half a days time plus some samples (about 1 fish per 100t of production). If the Inspector finds evidence of disease additional costs can be expected as he may require that the movement of fish be restricted, treatment of the fish with expensive medicines or in extreme cases the slaughter of all fish on site.

The regulation also requires farmers to keep movement and mortality records. FRS will also provide certification for live transport (including ova) to other EU countries. FRS will only charge for certification if there are unusual additional requirements of the 3rd country – for example when exporting to Chile.

Infectious Salmon Anaemia (ISA) was successfully eradicated in Scotland in the late 1990s by a full cull of infected populations and the substantial restriction on the operation and movement as a result of the requirement of the Fish Health Regulations (1997). It is understood that these are stronger measures than in force in other competitor countries – however as a result of this

strong position ISA has not returned to Scotland. It is not thought that the requirement to cull impacts upon insurance costs – as insurers will not pay out if the cull is directed by statute. The 2007 Act includes a provision that the Scottish Government may provide compensation should a cull be ordered. Any disease outbreak is likely to affect investor confidence, but Scotland benefits from the various mechanisms to ensure that the ISA-free status of the Scottish industry is maintained. The recent disease issues in Chile provide a clear example of the disastrous socio-economic impacts that can result from less stringent disease control.

FRS also collects flesh samples for veterinary residues testing – which also picks up on the use of illegal medicines. This is done by FRS under contract to Defra's Veterinary Medicines Directorate (VMD). These samples are collected at the same time as routine fish diseases monitoring. FRS will also advise the VMD on licensing trials. Maximal Residue Limits (MRL) will also be determined at the time of licensing. It is understood that there is no charge to the industry for the testing of medicines residues.

3.2.7 General operation

Rent

The Crown Estate is effectively the landlord for all seabed operations and is therefore able to charge an annual rent, which goes to the Treasury. A rent review was undertaken in 2006 to determine a more efficient, equitable market-sensitive approach to setting and collecting rents. The resultant system is based on a retrospective analysis of the previous year's production (production control forms are sent out in December and farms must report back annual gutted weight by 31st January).

The new rent rate is 1.7p/kg on harvested production and 1.53p/kg for production in the Western Isles and Northern Isles. It is understood that the new rates represent about an 8% drop on previous rents and typically represent between 0.5% and 1% of company turnover. The rental rate is also now dependent on salmon prices as it will reduce if the price on the Rungis wholesale market falls below €2.80/kg over a 6 month period, but would increase if the price rose above €7/kg for a 6 month period.

The Crown Estate commissions independent company production audits to ensure that production is as claimed. This is undertaken every 2 years for bigger companies and to date it is very rare to find anything of concern. Two months advanced notice is given and inspectors typically spend 2-3 days on site. The only difficulty can be on ascribing production to particular licences if the lease has multiple sites.

If nil production (fallow etc.) then a flat rate rent of £500/pa is charged for the first 4 years. Thereafter it is intended that the rent doubles every two years in order to create an incentive to use the site or not maintain the lease.

Vessels

There is a long and complex list of regulatory requirements for vessel safety and operation which applies to differing degrees for all fish farm vessels – work boats, landing craft and well boats. The standards which govern shipping are international and in the fish farming context apply equally to vessels operating in Chile, Scotland or Norway.

The International Maritime Organization (IMO) maintains a regulatory framework for shipping which provides a comprehensive body of international convention. In the UK inspection and monitoring of compliance is the responsibility of the Maritime and Coastguard Agency (MCA). The vessel MCA licence costs £285 per vessel. The costs of refurbishment of vessels to ensure compliance are highly variable and good practice dictates that maintaining seaworthiness should be undertaken as a matter of course.

All vessels are also required to carry VHF radios. The costs associated with this have recently reduced as a result of OFCOM dropping the annual licence fee for VHF radios, or the requirement for annual renewal of licences. However an annual cost of £360 still applies to licence VHF base stations. The number of base stations that a company requires will depend on the geography of operation, so in some cases one base station will be required per farm.

Impoundment

Any damming or impounding of water courses also requires inspection and approval under the Reservoirs Act 1975. Impoundments (>25 mega litres) are inspected annually by independent 3rd party civil engineers in order to assess the overall condition and safety of the dam structure. In addition a more thorough examination is required every 5 years. Most small impoundments used by hatcheries are not regulated under the Reservoirs Act 1975. Where required, the annual inspection typically costs around £5,000 per reservoir.

3.3 INDIRECT EFFECTS ON COMPANY AND SECTOR

3.3.1 Delay

There are a number of consenting or licensing processes, in particular during the planning and application stages which take time. Under normal circumstances the length of time from the site application to approval should be fairly predictable, with clearly stated time intervals for a number of key stages in the process. In spite of this, farmers continue to report uncertainty over the length of time the process is likely to take and few provide examples of a planning process taking the minimum stated time. More often, farmers refer back to experiences of protracted applications, and long delay – at times as much as 3 years.

There is also anecdotal evidence that the planning process is taking longer under the new local authority administered process. However, there does not appear to be a particular reason for this given that the stages in the new process are much the same as under the old system – or, if anything, represent a more streamlined process. It is also likely that applications currently being processed are in a transitional phase between the 2 systems. It is therefore likely that this process may become quicker once the new local authority procedure become fully established.

Most farmers report that it will take in the order of 5-6 months to identify a new site, undertake pre-consultations, collect background environmental data, model site hydrodynamics and prepare the planning application and any necessary environmental information. The planning application is then likely to take a minimum of 3 months to be processed – including all the consultation stages involved in arriving at a decision. Farmers tend to operate on a working assumption that it is likely to take at least a year from site identification to site approval.

An application for a CAR licence (discharge consent) can be made at the same time as an application for planning so delays quoted can be viewed concurrently, although some companies elect to only submit a CAR application once planning is completed. The CAR application process should, according to the legislation, take 4 months, however SEPA acknowledge that this is not yet being achieved. In practice, a CAR licence typically take 5-6 months to process. This process has speeded up considerably in recent years. In particular the advent of DEPOMOD, and subsequently Auto DEPOMOD II, has enabled farms to model their own hydrodynamic data – and model different potential farm configurations – before submitting the application. Such site modelling undertaken by or on behalf of operators amounts to on average £4,500. Previously this modelling work would have been undertaken by SEPA, but this development is generally welcomed as modelling by industry speeds up the application process and provides the applicant with a greater degree of confidence in planning decisions.

Typically the application for a Coast Protection Act licence from the MCA and a FEPA licence for a new pier (or other foreshore building works) (processed by FRS) takes in the order to 2

months. There is currently some debate over the potential requirement for a FEPA licence for other semi-permanent structures in the water such as well boats, which would result in additional costs for the industry estimated to be around £5,000 (the cost associated with a less complex FEPA application).

3.3.2 Uncertainty

One of the major indirect impacts of the regulatory structure referred to by fish farm companies who were interviewed was the uncertainty over planning applications. Because there is no clear strategic or spatial strategy for the Scottish west coast and islands, there are no areas where there can be a presumption for further development (although there are a number of areas where there is a presumption against development). As a result companies must invest considerable time and effort into planning applications without a clear indication that they are likely to succeed. To overcome this, companies are encouraged to undertake a pre-application consultation exercise with all the key stakeholders – in particular statutory bodies. However, it is argued that this is no substitute for the situation in other competitor countries where companies are able to purchase the licence for sites that have been made available by the statutory authorities.

Box 1 An example of the effects of uncertainty

A small-medium sized salmon farming company in Scotland needed to renew its 15 year licence after 29 years of operation, to secure a viable future. The application was turned down on the advice of the local authority. The principle objections were subjective issues which the company is unable to address in its company development strategy.

Consent was eventually given on appeal but only after a 4.5 year process during which the entire future of the company – and the 25 jobs of the employees – were in doubt.

Although planning consent is now granted in perpetuity, this example illustrates the difficulties existing aquaculture operations have faced despite the 'presumption of renewal' suggested.

3.3.3 Investment

It is unclear exactly what the implications of the regulatory system which governs the industry in Scotland have on investor confidence. Much will depend on the nature of the investor and it is possible that UK or even Scottish based investors may take a different view of the regulatory system than overseas investors; similarly the view of regulations may be affected by whether there is a long or short term investment strategy.

It is clear that some investors may be encouraged or reassured by the comprehensive nature of the regulatory structure associated with production within the EU– reducing the likelihood of avoidable losses as a result of catastrophic events such as major mortality, food safety, or environmental pollution. By avoiding such events the long term reputation of the industry in Scotland is enhanced, supporting on-going efforts to maintain the price premium. Investors will vary in the degree to which they recognise the contribution of regulation to achieving a premium.

Other investors may be concerned by the regulatory system that exists in Scotland. It is likely that concern will focus on a number of key points, namely:

- The overall cost of regulation – as quantified in this study
- The complexity of regulation and the large number of regulatory bodies
- The delay and uncertainly that planning regulations impose on the industry
- The amount of staff time involved in satisfying regulatory requirements.

It is likely that while investors would welcome the overall level of protection that regulation provides to the Scottish brand, operators would prefer this to be achieved in a more efficient way – with fewer regulatory bodies, more streamlined application processes, and less staff time.

The greatest single barrier to investors forming long term investment strategies in Scotland is the uncertainty that surrounds planning applications – in particular as a result of exhaustive consultation which is undertaken and the opportunity that this creates for other interest groups to influence the decision.

The level of uncertainty is currently heightened with development of new legislation in relation to marine management and marine nature conservation – such as the discussion in relation to a Marine Bill for Scotland, Marine National Parks, and Marine Spatial Planning.

3.4 SCALE FACTORS

Table 2 above presents the average regulatory costs associated with small farm sites (400t) and large farm sites (1,333t) as reported in the survey. The average capacity for a farm site in Scotland is estimated to be around 1,250t. Recent years have seen a move towards consolidation of sites and the expansion of existing sites to increase capacity.

As with the economies of scale that can be achieved on the overall cost of production, Table 2illustrates the comparative advantage of 1p/kg in regulatory costs that is achieved for large sites compared to small sites. Much of this relates to the planning process; both sites incur similar costs which on a £/kg basis favours the site with the largest production.

Other important gains for the larger production site are in SEPA charges which operate on a broad banding system; and routine monitoring where costs are not proportional to site capacity. All other key regulatory costs and the user charge (Crown Estate rent) are either directly proportional or closely correlated to the capacity of the site.

In addition to scale factors existing on a farm site level, scale has an influence on regulatory costs at a company level. The larger the company the more likely it is to employ in-house capacity to produce EIAs, planning applications and applications for CAR licences – most of which during the course of routine production are likely to be applications for technical variations.

In some cases this in-house capacity will include almost all requirements such as hydrodynamic modelling and routine benthic monitoring. Even the largest producers cannot justify employing all expertise in house and hence the most specialist services are still undertaken by third parties.

For smaller companies with fewer sites there is not the volume of regulatory work to justify retaining in-house expertise. It is therefore relatively more expensive for these companies to put together applications or comply with production regulations.

The more subtle influences of regulation on scale and the ability of companies to expand (and so affecting development in the sector) are discussed in section 7.

4 REGULATION IN NORWAY – NATURE AND COSTS

4.1 REGULATORY COSTS

Table 4 overleaf presents the regulatory costs associated with various scales of Norwegian salmon farms. Norwegian farm sites hold between 1 and 5 licences with the average being 3 licences. A production licence permits a maximum standing biomass (MSB) of 780 tonnes (except the northern counties of Finnmark and Troms where 900 tonnes MSB is permitted). The average annual production per licence for all counties other than Troms and Finnmark was 960t. Therefore the average farm site holding 3 licences produced 2,880t per annum. Scale issues are considered further in section 4.4, scale factors.

When the purchase of production licences is included, the total regulatory costs identified for the average site amounted to 5.6p/kg based on a 10 year return period. 80% of these costs relate to the assumed repayment of the production licence over a 10 year period, which equates to 4.5p/kg. The Norwegian production licence is effectively a user charge as it is a mechanism for generating revenue for the public purse, but can be considered a regulatory cost as production is not permitted without a licence.

The decision to exclude or include the production licence is critical to calculation of regulatory costs and also the overall cost of production. Its treatment in Norwegian statistics and accounting differs as it is generally presented as a company asset, but not a cost that is reflected in annual production. This is to be expected as there have been many different routes to acquiring licences that are reflected in a company's balance sheet rather than in operational costs.

The average Norwegian company holds 5.1 production licences, resulting in an average 4,924t of production per annum. The ownership of 5.1 licences represents an asset value to a company estimated at over £2 million. Since 2001 new licences have been sold in licensing rounds by the government, but prior to this date they were allocated to companies. Therefore existing companies have not incurred the full potential cost, but this would be a major establishment cost to new entrants and is treated as a tradable asset representing potential future production.

4.2 DIRECT EFFECTS ON COST OF PRODUCTION

The central piece of legislation regulating the Norwegian salmon farming industry is the Aquaculture Act (Act. of 17. June 2005 no. 79 relating to aquaculture). This states:

> *"The purpose of this Act is to promote the profitability and competitiveness of the aquaculture industry within the framework of a sustainable development and contribute to the creation of value on the coast."*

Present legislation and its practical implementation follows the spirit of the Aquaculture Act in order to limit or eliminate negative externalities to the environment and other user interest without imposing unnecessary regulatory costs that reduce the industry's competitiveness and profitability.

The Aquaculture Act covers the establishment of a new farm (including applications for increased production). The government's licensing system effectively limits the total production in Norway since both the total number of licences and the production volume under each licence are limited. Both political pressure from the EU and economic sustainability considerations by the Norwegian government have acted as brakes on the expansion of the total licenced production volume. For the country as a whole there are still plenty of available sites that could potentially be used for salmon farming when environmental (e.g. organic emissions, externalities to wild salmon etc.) and competing user (sea transportation, recreational use, fisheries, etc.) considerations are taken into account.

Table 4 Annual regulatory costs for Norwegian salmon farm sites (including price of production license based on a 10 year return period)

Size and annual production (live weight)	**Small site (1 licence, 960t)**			**Average site (3 licences, 2,880t)**			**Large site (5 licences, 4,800t)**		
	Cost of regs (£/yr)	Cost of regs (£/kg)	% of reg costs	Cost of regs (£/yr)	Cost of regs (£/kg)	% of reg costs	Cost of regs (£/yr)	Cost of regs (£/kg)	% of reg costs
Planning	50,545	0.053	75%	143,035	0.050	89%	236,525	0.049	93%
Payment for licence (excl.Troms & Finnmark)	42,755	0.045	63%	128,265	0.045	80%	213,775	0.045	84%
Application for aquaculture licence	115	0.000	0%	345	0.000	0%	575	0.000	0%
Application fee for new site	3,375	0.004	5%	10,125	0.004	6%	16,875	0.004	7%
Measurement of currents	128	0.000	0%	128	0.000	0%	128	0.000	0%
Recipient analysis	171	0.000	0%	171	0.000	0%	171	0.000	0%
Measurement of depths	43	0.000	0%	43	0.000	0%	43	0.000	0%
Estimates of waves, etc.	43	0.000	0%	43	0.000	0%	43	0.000	0%
Impact assessment	-	-	0%	-	0.000	0%	1,000	0.000	0%
Internal work application	1,688	0.002	3%	1,688	0.001	1%	1,688	0.000	1%
Internal audit system development	2,228	0.002	3%	2,228	0.001	1%	2,228	0.000	1%
Buildings & Equipment	2,205	0.002	3%	2,205	0.001	1%	2,205	0.000	1%
Certification of farm installations ("NYTEK")	2,205	0.002	3%	2,205	0.001	1%	2,205	0.000	1%
Raw materials	-	-	0%	-	0.000	0%	-	-	0%
Smolt & Feed		-	0%		0.000	0%		-	0%
Staffing	13,050	0.014	19%	13,050	0.005	8%	13,050	0.003	5%
Report monthly figures to government	2,700	0.003	4%	2,700	0.001	2%	2,700	0.001	1%
Work inspection DF and FSA	1,350	0.001	2%	1,350	0.000	1%	1,350	0.000	1%
Revision of internal audit system	9,000	0.009	13%	9,000	0.003	6%	9,000	0.002	4%
Environmental	1,300	0.001	2%	1,300	0.000	1%	1,300	0.000	1%
Peak biomass survey	300	0.000	0%	300	0.000	0%	300	0.000	0%
B-trend analysis	1,000	0.001	1%	1,000	0.000	1%	1,000	0.000	0%
Disease and food safety	-	-	0%	-	0.000	0%	-	-	0%
General operation / other	299	0.000	0%	299	0.000	0%	299	0.000	0%
Fee for inspections by DF and FSA	299	0.000	0%	299	0.000	0%	299	0.000	0%
TOTAL	**67,399**	**0.070**	**100%**	**159,889**	**0.056**	**100%**	**253,379**	**0.053**	**100%**

Planning

Planning a new farm involves identifying possible sites, scoping those sites and submitting an application for the farm site to the Directorate of Fisheries. The government has prohibited fish farming in many areas due to possible effects on environment, wildlife, other commercial activities, recreational activities, etc.

When one or more candidate sites have been identified key site attributes are analysed including:

- 2 weeks worth of hydrodynamic data.
- Recipient conditions (fauna etc.).
- Topography, which involves measurement of depth at 10 meter intervals.
- Planned annual production volume (non-binding at this stage, merely to inform Government carrying capacity assessments).
- Other environmental conditions such as salinity, temperature / ice conditions and salmon lice.
- Farm infrastructure (platform, cages, anchoring system, etc.) including maps and product capability certificates.
- Impact assessment (for farm with 4 or more licences) which includes possible effects on environment, wildlife, other commercial activities, recreational activities, etc.

For an average farm site of 3 licences, the above costs amount to around £10,000. For larger sites requiring impact assessment, impact assessment costs amount to an additional £10,000.

In considering the application the Government will assess the risk of disease transmission informed by distance to other farm sites, taking into account topography and currents etc. The recommended minimum distance is typically 5 km between farms. The cost of this service is incorporated in the licence application fee (around £1,000 per licence).

Licensing

Production licences are required in addition to the planning consent. The application for a new salmon farm licence is regulated by five different acts;

- the environmental emissions act ("forurensningsloven"),
- the food safety law ("matloven"),
- the aquaculture act,
- the harbour- and coastal transportation act ("havne og farvannsloven"),
- the water resource law ("vannressursloven").

Several public bodies are involved in the application process; the Directorate of Fisheries (which coordinates the process), the relevant municipality, the Norwegian Water Resources and Energy Directorate, the Local Authority ("Fylkesmannen"), the Norwegian Coastal Administration ("Kystverket") and the regional office of the Norwegian Food Safety Authority ("Mattilsynet").

The smallest unit that is regulated by the Norwegian government is a production licence. In most counties this licence allows for a maximum allowable standing biomass (MASB) of 780 tonnes. In the two northernmost counties Troms and Finnmark, which represented 13% of the total Norwegian production in 2006, the MASB is 900 tonnes. In 2006 the average national production per licence was 960 tonnes, while for Troms and Finnmark it was 750 tonnes. This reflects the lower productivity in Troms and Finnmark due to temperature and light conditions.

A farm is typically allowed to have from 1 to 5 licences, depending on the capacity of the site. In other words, a farm site will have a maximum allowable standing biomass from 780 tonnes (1 licence) to 3900 tonnes (5 licences). Based on national average production in 2006, this means a production from 960 tonnes (1 licence) to 4800 tonnes (5 licences) at one site.

The Norwegian government has been fairly restrictive in the issuing of new licences after the 1980s, primarily due to economic sustainability considerations. The last national licence round was in 2002-3, which involved 38 new licences. The government assesses the ability of the applicant to realise the potential of the site and the applicant's existing or planned economic activity in the region.

Those companies that were allocated licences in the 2002/2003 round had to pay a fee of 5 million NOK (over £400,000) per licence, or 4 million NOK (£340,000) if the licence was in the northernmost counties of Troms and Finnmark. In 2006 there was a further licence round for 10 new licences for the county of Finnmark only.

Historically if a company went bankrupt the production licence would be taken back by the government. This reduced the total value of the assets of a liquidated company considerably and probably led to interested parties including banks sustaining companies that should have been declared bankrupt. This government practice has now ended after new legislation was introduced. This means that assets can now be valued as in other industries. The valuation of salmon farming assets are in practice based on price expectations etc., which exhibit huge swings over time primarily due to market price variations.

An existing salmon farm licence can also be bought from another company. According to the regulation a permit must be obtained from the Ministry of Fisheries and Coastal Affairs if the buyer achieves control over more than 15% of the total Norwegian MASB in the form of direct or indirect ownership. Control of more than 25% of the total domestic MASB is prohibited. No company or individual can control more than 50% of the total MASB within each of the fishery authorities regions.

Farm Technical Installations

According to Norwegian (NYTEK) Regulations laid down by the Ministry of Fisheries and Coastal Affairs), all farm technical installations have to be approved and certified. The government's primary concern behind the certification is to minimize the escape of farmed salmon to the environment, and to reduce the risk of genetic pollution of wild salmon. The Directorate of Fisheries has formulated a "zero escape vision" for the aquaculture industry.

A Norwegian standard has been developed and mandated by law that places technical requirements on the dimensioning, design, installation and operation of floating fish farming installations. This standard was developed by Standards Norway in cooperation with representatives from the industry, research institutions and authorities. Standards Norway is working on internationalization of the standard through ISO.

Before a fish farmer can purchase new installations or receive a capability certificate for existing installations, the locality must be classified. This is based on the wind, current and wave conditions. This information is produced as part of planning costs outlined above.

Manufacturers of fish farming installations, including floating collars, rafts, barges and nets, must have their products certified by an accredited certification body if they want to deliver their products to Norwegian fish farms. They must also provide a user handbook for the installation or main component.

Farm operation

Regulation FOR 2004-12-22 no 1785, which regulates fish farm operations, states that farm operations must be technically, biologically and environmentally sustainable. The monthly pro forma reporting to DF enables government oversight at a staff cost to the company of only a few hundred pounds per site year. Should this reporting show anomalies (a rare occurrence), additional inspection is carried out by DF staff.

Industry representatives confirm that the government regulation of farm operations largely correspond to what is good business practice. This means the vast majority of the measures would have been implemented even if the regulations were not present. Buyers of salmon (e.g. retail chains) are one of the drivers. Another driver is the disease pressure in the industry, which means that most companies follow a very precautionary approach in all activities that entail stress for the fish or risk of disease transmission.

Raw materials

The most important input in salmon farming is feed with a production cost share above 50%. Norway is a member of the European Economic Area (EEA), which means that it has to adopt most EU directives into national legislation and regulations. Currently there are no regulations on salmon feed raw materials and production of feed that put the Norwegian industry at a disadvantage compared to other EU farmers.

In most instances there is relative parity between Norwegian and EU regulations on raw materials, and buyer requirements are generally the limiting factor for ingredients in salmon feed.

Staffing

Farm managers are required by regulation to have an aquaculture specialization at high school level VKII, or equivalent formal aquaculture training. Specifically, the manager should have the necessary competence to prevent, detect and limit the escape of fish. There should also be enough personnel to ensure the welfare of the fish. The competence must be documented through practical and theoretical training. The training programme, which must be approved by the Food Safety Authority, must be undertaken by the company and repeated every five years. This training is viewed by the sector as part of good industry practice and represents minimal additional staff costs of a few hundred pounds per annum per employee.

Environment

The Aquaculture Act specifies that aquaculture facilities shall be established, operated and abandoned in an environmentally responsible manner.

Environmental inspections are undertaken when the biomass is at its peak in the production cycle at the farm site at a cost of around £300 per year for the company. If this analysis indicates unacceptable environmental conditions, then an expanded inspection is undertaken resulting in additional costs to the company. The government can demand that the site is abandoned if the environmental parameters show unacceptable levels.

A salmon company will have access to several sites which are used in rotation. Environmental and fish disease considerations are important determinants of site rotation. All sites should have an operations plan for the next two years for the rotation of sites. This

plan should specify in which sites smolts should be released, when and how many smolts. Further, it should specify the possible abandonment of locations and for how long they will be inactive. Operations and the abandonment of sites should, according to the regulation, be facilitated in a way that increases productivity and economic return. This operational planning is part of the internal audit system which is initially developed during planning and undergoes annual revision at an average cost to the company of £1,300 per site per year.

A benthic survey (a so-called "B trend analysis") is undertaken by contractors every second year that costs 20-25000 NOK (av. £1,000 per site per year)

Disease and food safety

Regulation FOR 2004-12-22 no 1785 specifies several measures to prevent disease outbreaks, limit the effects of diseases, and reduce the risk of transmission between farms. The DF and FSA check compliance as part of their annual inspection (shown within general operation) costing the company around £300 per site per year. The following are considered:

- Rotation.
- Maintenance.
- Cleaning and disinfection of equipment and workers.
- Transportation of people and fish between farms, fish processing facilities, etc.
- Health inspection by veterinarians.
- Daily registration of mortality and causes of mortality.
- Sampling of fish for examination when there is suspicion of disease.
- Limit emissions of medicines and chemicals to the environment.
- Reporting of fish disease.
- Equipment design shall promote animal welfare, easy maintenance, cleaning and inspection.
- Sufficient water flow through the cages.
- Feeding procedures to promote animal welfare.
- Handling of fish in sorting etc. Fish handling should be kept at a minimum.

It is prohibited to slaughter fish at farms. Dead fish must be stored in a closed compartment and later transported away for safe destruction.

General operation

To ensure that salmon companies systematically follow the Aquaculture Act and the regulations derived from it, the Norwegian government has mandated that companies shall have a formal internal audit system, as mentioned under the 'environment' section above. It can be argued that an appropriately designed internal audit system will be an element of good business practice in salmon farming anyway, and many companies probably have internal audit systems that go well beyond the requirements of the regulation because of stricter buyer requirements. The internal audit system regulation requires that:

- Relevant laws and regulations are available for employees.
- Employees are up to date competent in the company's internal audit system.
- The company has stated targets for the internal audit work.

- The company has clearly defined internal responsibilities.

- The company has undertaken systematic risk analysis and planning.

- Procedures are in place to prevent, identify and rectify unacceptable conditions.

- The internal audit documentation is available together with licences, certificates etc.

Every month each farm reports the following information to the authorities: (a) Number and age of new fish (smolts) released into the cages, (b) stock of live fish (number and age group), (c) biomass in kg, (d) harvested quantity (number of fish, average weight), (e) movement of live fish to other locations, (f) fish losses (number of fish, causes of losses), (g) feed consumption in kg and by feed type, (h) number of sea lice and sea lice treatments.

4.3 INDIRECT EFFECTS ON COMPANY AND SECTOR

Delay

The processing of applications for the use of a new site and applications for the expansion of production can be time consuming, and will normally take 6-18 months. Salmon farming companies must therefore take this long processing time into account and apply well before the planned move or expansion.

A central determinant of the speed of processing is the response from other user interests (fishers, transportation sector, etc.) in the public hearing. If other user interests present weighty arguments against the use of a particular site, then this may cause a major delay. Good pre-application scoping by a fish farming company should provide an idea of potential problems and likely delay. Such scoping may lead to the conclusion that an application should not be sent for a particular site, to avoid a time-consuming process.

Compliance

The reported level of compliance is high. The Aquaculture Act specifies government sanctions (fines etc.) if violated. A central principle is that fines should be larger than the net revenue gain from any violation. In the event of gross or repeated violation, aquaculture licences can be revoked.

Companies are restricted by the maximum allowable standing biomass (MASB) regulation keep the biomass of live fish in the cages at all times below the MASB level. Due to the uncertainty regarding temperature, diseases and other biophysical factors, there is an uncertainty range around the biomass forecasts for a cohort of salmon. If conditions throughout the production cycle are beneficial, then the biomass could at some point in time be higher than the MASB. It is the responsibility of the salmon farming company to avoid this, but it is a challenge in the company's planning to determine how conservative it should be in order to reduce the risk of MASB violation.

If the biomass exceeds the MASB, then the company is subject to a fine equal to the difference between the actual biomass and the MASB in kilo multiplied by a unit value that reflects the current market price.

4.4 SCALE FACTORS

Table 4 above illustrates the economies achieved on regulatory costs as farm sites increase from 1 licence (7p/kg) up to 5 licences (5.3p/kg). This is a result of many costs being on a per site basis rather than being relative to scale. One additional cost triggered by the larger sites is the requirement for EIA which is a minimal one-off cost when considered over a 10 year return period.

In contrast to the economies of scale that are evident with larger sites, at a company level, the largest Norwegian companies show the highest regulatory costs. This is a consequence

of the most regulatory costs for Norway being one-off costs associated with planning. Even when the major cost of the licence itself is not included, when considering planning costs over a 10 year return period, the large companies that hold large numbers of licences (around 38 licences) exhibit relatively large planning costs. These costs include the licence application and associated surveys which do not show any economies of scale.

In practice these costs occur over a longer time period and/or through licence acquisition, reducing the annual costs incurred by a company. It should also be remembered that the additional regulatory costs of large operators are insignificant when compared to the economies of scale that are achieved elsewhere.

5 REGULATION IN CHILE – NATURE AND COSTS

Note: exchange rate used is US$1 = £0.4999; approx. £1≡ US$2 (average exchange rate for 2007).

5.1 REGULATORY COSTS

Table 5 overleaf presents a breakdown of regulatory costs per year over a 10 year return period for an average sized production site of 4,442t. Annual regulatory costs amount to £37,587 per production site which on a £ per kilo basis amount to £0.0085/kg or 0.85p/kg. These costs amount to only 0.7% of the costs of production (£1.21/kg before harvesting costs).

The largest single regulatory cost category is that of 'disease and food safety' which accounts for 72% of all regulatory costs. The largest component of these costs is for residue analysis undertaken by Sernapesca.

In spite of the successful development of the farmed salmon industry in Chile, recent disease outbreaks and criticism from NGOs of the industry's environmental impacts and labour rights have prompted a reassessment of industry development – both on the part of the Government and the industry itself – focusing on those areas of concern where there is potential to improve performance.

To facilitate improved regulation in the Chilean industry the 2003 National Aquaculture Policy ("Polítca Nacional de Acuicultura" - PNA) was implemented as a legal framework to coordinate a range of policies and legal bodies that relate to aquaculture activity. This review led to the establishment of a "single window" within the fisheries department (SERNAPESCA) to process all practical paperwork, permits and licensing. The majority of these can now also be done on-line over the internet.

5.2 DIRECT EFFECTS ON COST OF PRODUCTION

Farm establishment

The General Law for Fisheries and Aquaculture establishes both the Aquaculture Authorization (freshwater) and concession (marine) permits required for operation. If everything is presented and approved by the corresponding authorities it is estimated that a concession could be obtained in a period of 2–4 years. As discussed below this lengthy process has resulted in negative consequences for the sector's development.

The costs for the establishment of farms vary between £15,000 and £25,000. This cost will depend on the number of hectares requested, location (further south is more expensive) and internal company time spent in the project.

The purchase cost of a farm with all the papers ready, but without any capital investment and fish, varies between £50,000 and £100,000, depending on the location and number of hectares. Once the concession is authorized, the company has 1 year to start the operation according to the Technical Project presented.

The 1991 General Fishing and Aquaculture Law established specific fish farming areas at sea to ensure that they do not conflict with other activities (fishing, navigation, tourism and nature protection). Concessions cannot be authorized in Marine Reserves (reproduction areas for fish stocks) and in the recently created Marine Parks. Aquaculture areas and boundaries in marine waters have been defined by decree in eight regions. No further aquaculture areas can be authorized in Chilean lakes. This restriction has contributed to the spread of inland aquaculture in ponds as well as inland freshwater production facilities.

Table 5 Costs of production and regulation for Chilean salmon farm

	Average production per site = 4,442t	Cost of regulation (£ per year)	Cost of regulation (£ per kg)	% of total regulatory cost
1	**Planning**	**£2,035**	**£0.0005**	**5%**
1a	Cartography – external	£214		
1b	DIA - environmental study – external	£243		
1c	CPS - preliminary site assessment – external	£501		
1d	License of Concession – payment	£81		
1e	Publication in Official Newspaper – payment	£17		
1f	City License – payment	£245		
1g	Site Identification - internal work	£507		
1h	Registration process - internal work	£226		
2	**Buildings & Equipment**	**No regulatory costs**		
3	**Raw materials**	**No regulatory costs**		
4	**Staffing**	**£4,237**	**£0.0010**	**11%**
4a	Wages	£4,237		
4b	Safety compliance/training			
5	**Environmental**	**£3,245**	**£0.0007**	**9%**
5a	Routine monitoring INFA	£3,245		
6	**Disease/Food Safety**	**£ 26,991**	**£0.0061**	**72%**
6a	Health & Safety	£3,770		
6c	Residue analysis	£ 18,468		
6d	Prohibited substances	£ 876		
6e	Non authorized substances	£1,034		
6f	Fish movement	£1,324		
6g	Active Fish Disease Survey	£1,519		
7	**General operation / other**	**£3,113**	**£0.0007**	**8%**
7a	License of Concession	£ 743		
7b	City License	£2,370		
	TOTAL	**£ 37,587**	**£0.0085**	**100%**
	Harvest cost			
	Total (incl. harvest cost)	**£ 37,587**	**£0.0085**	**0.7%**

Supporting Documentation

Installation requires detailed data on environmental conditions and sea bed composition. The Reglamento Ambiental de la Acuicultura (Regulation for aquaculture environmental monitoring – RAMA) introduced preliminary site characterization (CPS), which requires any new production licence request (inland or marine) to be subject to an Environmental Impact Assessment (Declaración de Impacto Ambiental - DIA).

The cartography – maps, DIA and CPS - needs to be done by a third party and the cost will depend on the number of hectares requested, location and category of the site.

Licensing

The Concession License (Patente Única de Acuicultura) is paid to the Tesorería General de la Repúbilca once a year during the month of March. The amount to be paid is directly related to the number of hectares owned and corresponds to 2 UTM (Unidad Tributaria

Mensual) per hectare.[2] The only legal reason not to pay this fee is if there is a natural catastrophe (as in Aysen región – year 2007).

In addition a City Licence is required. This payment is dependant on the investment declared, labour used and area / region of operation. It is paid twice a year and the cost could vary between US $ 3.600 and US $ 5.600 / per site / year.

Infrastructure

Although there is no legislation controlling installation specifications, many companies comply with the Norwegian standard NS9415. This has reduced the number of mooring failures as well as equipment and fish losses over recent years.

Health and Safety

Companies have to pay a basic 0.9% of the gross salary of the employees, plus an additional variable % according to the activity and risk. This will directly depend on the Tasa de Riesgo of the whole company. The maximum amount to be paid for this concept is 3.4%. Therefore, there is whole company Health and Safety cost, rather than a site specific cost.

In this analysis an average rate of 2.65% was used for all of the sites and was related to the number of people working and their salaries (between US $ 4.600 and US $ 9.700 / year). A typical production site employs a Site Manager, 2 or 3 Assistant Managers and 4 or 5 site workers.[3]

Environmental

Because growth in the industry has largely been export-driven, corporate environmental responsibility is improving, particularly amongst the largest farms and companies and a voluntary Clean Production Agreement ("Acuerdo de Producción Limpia" – APL) was signed by the producers in 2002. The agreement set a target for sewage treatment and solid waste management to bring producers in compliance with current environmental standards. It also addressed the control and eradication of high-risk diseases. Environmental certification of salmon farming has increased and many of the largest farms are ISO 14001 certified on a voluntary basis. A voluntary Code of Good Environmental Practices that includes sustainability criteria for all stages of salmon farming has also been developed.

From a regulatory perspective, every site needs to undertake an Environmental Site Assessment (INFA) once a year. This must be done by a certified company when the site has the maximum existing biomass in the year. An INFA costs the company between US $ 3.500 and US $ 8.500 / per site / per year. It will vary according to the category of the site and location. This information goes to Sernapesca, which evaluates the site information. If anaerobic conditions prevail in top sediments under cages for two consecutive years, the farm site must reduce by 30% the biomass produced in the third year and every year thereafter until oxygen conditions in sediments improve.

Disease and Food safety

With the intensification of the industry in Chile a number of diseases have become prevalent including bacterial pathogens (*Vibrio sp., Streptococcus, Aeromona salmonicida atypical, Piscirickettsia salmonis*), sea lice (*Caligus rogercresseyi.*), Infective Pancreatic Necrosis Virus (IPN) and most lately Infectious Salmon Anaemia (ISA).

[2] One UTM in Chile correspond to a Unidad Tributaria Mensual and it varies month by month. This is determined by the government.

[3] Mortality extraction is done by external service (divers) as well as net changing / maintenance

The recent incidence of these diseases and the continued use of antibiotics and parasiticides have raised concerns. It is now a requirement for all batches of harvested salmon for both the US and Japanese markets to be tested for residues. The Sanitary Regulation (Sernapesca – Fishery authority) on prevention and control of high-risk diseases in aquatic species provides for sanitary control, epidemiologic monitoring and eradication of infectious diseases in fish farms. Also Sernapesca's residue control programme has been given more resources with the number of site inspections increasing.

Within the Sernapesca`s Sanitary Program, there is a Program for Fish Disease Survey called Programa de Vigilancia Activa para Enfermedades de alto Riesgo. This program considers a survey visit and samples for analysis to all of the sites, twice a year (minimum 4 month between one and another visit). The cost per site is estimated between US $ 2.200 and US $ 3.400 / per site / per year according to the size of the site and location.

Residue Analysis

All farms need to be registered to participate in the Programa de Control de Residuos (Residue Analysis Program). Sernapesca is in charge of verifying the authorizations and program process. The farm must declare that harvested fish have no residues or concentrations above the limit established by Sernapesca.

The numbers of samples vary according to the number of fish per site, number of cages, number of treated groups etc. The estimated cost for this concept could vary between £8,000 and £28,000. This represents the most expensive of all the regulatory costs in Chilean aquaculture.

Contaminant and Prohibited substances

This cost follows the same concept as described above in the Program of Control of Pharmaceutical Residues (approximately US $ 2.000 / per year / per site). It is done once a year (5 samples per site).

The same applies for non authorized substances (approximately US $ 2.000 / per year / per site), which includes the analysis for Malachite Green and Violet Cristal residues prior to harvest.

Fish movements

This has become one of the most important recent areas of regulation, especially following the outbreak of ISA. Movements of fish are restricted according to where they are coming from and where they are going to. Sernapesca has established:

- Quarantine zones;
- Vigilance zones;
- Free of diseases zone.

In order to move fish from one zone to another, fish need to have a Certificate of Health. The cost for this is difficult to establish, but is estimated to be between £1,100 and £1,400 per site / per year.

Regulatory Compliance

All the activities requested by the government in order to comply with the regulations are done according to the Concession registered in Sernapesca. Therefore multiple sites in one concession are actually managed as a single unit and payments are calculated as one full package.

An average of US$ 75,000 is paid by year per concession in order to comply with the Chilean regulations. This cost is very low compared to the total production / operational cost. It can be seen that the main cost is related to the program of residue control.

5.3 INDIRECT EFFECTS ON COMPANY AND SECTOR

Regulatory delay

The impact of regulatory delay can be appreciated in relation to new site authorization (the regulatory process takes up to 4 years). This has forced the salmon companies to increase production in existing sites, at higher densities and exposing themselves to diseases like SRS, *Caligus* and most recently to ISA.

It is also most probable that new regulations will be introduced, particularly related to maximal biomass of production per site, distance between sites, new and stricter sanitary programs and more stringent environmental survey.

Level of compliance

Sernapesca state that most of the non-compliances are related to registration problems and site information that was not delivered to Sernapesca on time (related to harvest, fish movement, etc.).

Fines vary between 30 and 300 UTM (Unidad Tributaria Mensual) or £1,200 to £12,000. Some politicians consider these to be too low to act as a disincentive. Draft legislation is proposed that is expected to result in substantial increases in the overall level of fines and making these proportionate to the level of non-compliance. In order to apply this legislation the Ley general de Pesca y Acuicultura will need to be modified.

5.4 SCALE FACTORS

A summary of the different costs for regulatory compliance is presented in Table 6 below.

The cost of Regulatory Compliance represents about 0.7% of the production costs. In general terms a larger site pays proportionally less costs for regulatory compliance compared to a smaller site.

Table 6 Regulatory costs for Chilean salmon farms (£)

Regulatory Cost	Average site (4,442t)	Small site (1,800t)	Large site (6,831t)
Person in charge Enviro / Concessions	4,237	2,031	4,514
Patente de Acuicultura – Licence Concession	743	786	1,021
City Licence	2,370	903	2,821
Health & Safety	3,770	2,379	4,477
INFA Environmental Study	3,246	1,774	3,734
Residue Analysis	18,468	8,057	26,587
Prohibited Substances	876	420	933
Non authorized substances	1,034	560	1,120
Fish Movement	1,324	1,129	1,411
Active Fish Disease Survey	1,519	1,129	1,693
Total Regulatory costs	**37,587**	**19,167**	**48,311**

6 COMPARISON OF REGULATORY COSTS IN SCOTLAND, NORWAY AND CHILE

This section collates and discusses the modelling results. In attempting to explain these, additional anecdotal and qualitative information is used. This was derived from producer consultation and further augmented by consultation with regulators, agencies and suppliers.

6.1 COMPARATIVE COSTS OF REGULATION

Tables 7**Error! Reference source not found.** and 8**Error! Reference source not found.** overleaf present the consolidated findings from the survey of producers undertaken in Scotland, Norway and Chile. The following assumptions have been made:

- A 'farm site' was identified as the production unit that was comparable across the 3 countries, but this differed in scale. Average annual production per 'farm' was estimated at 1,125t for Scotland; 2,880t for Norway and 4,442t for Chile.[4]
- In order to generate a cost/kg for up-front investment in site planning and establishment (including licence purchase) we have allocated these costs over a hypothetical 10 year investment cycle.
- Financing charges (interest on capital investment; interest on working capital) have not been included. Although these influence overall profitability, they relate to a company cost rather than a production cost and vary markedly between companies. Section 7 discusses the regulatory implications for sector development, which includes consideration of these aspects.
- Harvest and transport costs are not included in the analysis, which is based on production to 'farm gate' as in many instances these costs are not separated.
- Average 2007 exchange rates are used for conversion into £ Sterling (0.4999 US$ and 0.08551 NOK to £1).

The direct cost of regulation identified by the survey amounts to 5.6p/kg for Norway, 3.7p/kg for Scotland and 0.9p/kg for Chile (Table 7).

The largest cost of regulation is the user charge (the Norwegian production licence and the UK Crown Estate rent**Error! Reference source not found.**). UK regulatory cost almost doubles if Crown Estate rental costs are included, while for Norway user charges amount to around 80% of total regulatory costs. For Chile, while licences are required, no user charge based on production volume has been identified.

The total direct cost of regulation to producers differs markedly between producer countries if the cost of production licences in Norway and CE rents in Scotland are excluded (Table 8**Error! Reference source not found.**). Without user charges for Scotland the direct cost of regulation on the costs of production are estimated at 2.1p/kg, while for Norway and Chile the impact of the costs of regulation on those of production are less at 1.1p/kg and 0.9p/kg respectively.

[4] Average farm site production volumes were based on reported industry averages.

Table 7 Direct impacts of regulation on costs of production, 2007 (including user charges*)

		Total regulatory costs from survey (£/kg)			Regulatory costs as % of total regulatory costs		
	Avg production (t)	1, 125	2,880	4,442	1, 125	2,880	4,442
		Scotland	**Norway**	**Chile**	**Scotland**	**Norway**	**Chile**
1	**Planning**	0.0019	0.050	0.0005	5.06%	89%	5%
	CAPITAL COSTS						
2	**Buildings & Equipment**	0.0007	0.001	0.0	1.80%	1%	0%
	OPERATING COSTS						
3	**Raw materials**	0	0	0.0	0.00%	0	0%
4	**Staffing**	0.0008	0.005	0.001	2.23%	8%	11%
5	**Environmental**	0.0149	0.000	0.001	39.83%	1%	8%
6	**Disease/Food Safety**	0.0014	0.00	0.0061	3.61%	0%	68%
7	**General operation**	0.0178		0.001	47.48%		8%
	TOTAL (excl planning)	0.0356	0.006	0.0085			
	Total (incl. planning)	**0.0374**	**0.056**	**0.0089**	**100%**	**100%**	**100%**

*User charges identified are costs of production licence (Norway) and Crown Estate rental costs (Scotland)

Table 8 Direct impacts of regulation on costs of production, 2007 (without user charges*)

		Total regulatory costs from survey (£/kg)			Regulatory costs as % of total regulatory costs		
	Avg production (kg)	1, 125	2,880	4,442	1, 125	2,880	4,442
		Scotland	**Norway**	**Chile**	**Scot**	**Nor**	**Chile**
1	**PLANNING COSTS**	0.0019	0.005	0.0005	9.6%	47%	5.1%
	CAPITAL COSTS						
2	**Buildings & Equipment**	0.0007	0.001	-	3.4%	7%	0.0%
	OPERATING COSTS						
3	**Raw materials**	-		-	0.0%		0.0%
4	**Staffing**	0.0008	0.005	0.0010	4.2%	41%	10.7%
5	**Environmental**	0.0149	0.000	0.0007	75.8%	4%	8.2%
6	**Disease/Food Safety**	0.0014	0.000	0.0061	6.9%	0%	68.1%
7	**General operation**	-	0.000	0.0007	0.0%	1%	7.9%
	TOTAL (excl planning)	**0.0178**	**0.006**	**0.0085**			
	Total (incl. planning)	**0.021**	**0.011**	**0.0089**	**100%**	**100%**	**100%**

The higher regulatory cost for Norway is a result of the inclusion of a major up front investment in production licences (with licences purchased after 2001 averaging over £400,000). Based on a 10 year return period the licence amounts to 4.5p/kg on the cost of actual production. However only production licences issued after 2001 were subject to this charge, therefore these costs to production would not apply to established farms. Additionally, these licences are indefinite and treated as an important asset by companies. Writing down over 10 years may therefore be misleading. User charges are discussed in more detail in section 6.8 on 'general operation' below.

Excluding user charges (Table 8), identifies that other regulatory costs in Scotland are higher (almost double) than those in Norway and Chile. The next largest regulatory cost category for Scotland is 'environment' accounting for around 40% of total regulatory costs. These costs are mainly attributable to SEPA charges, but also include third party costs for required surveys and staff costs to undertake in-house monitoring and co-ordinating mandatory environmental reporting. In contrast Norway reports no direct environmental regulatory costs as these are deemed by the companies to be part of good practice. A cost for the regular benthic analysis (B-trend analysis) is, however, included as it is a regulatory requirement per production cycle. Some costs are identified for Norway under 'staffing' for mandatory reporting and under 'general operation' for government inspections, but together these are still minimal compared to 1.5p/kg for Scottish environmental costs.

With large volume production even small fractions of COP can be important and worthy of further of investigation, but they should be considered in context. Table 9 below shows recent exchange rate changes for the main currencies used by the producers in each country. It illustrates that currency fluctuations affecting the purchase price of various inputs have been greater than the proportion of costs of production directly attributable to regulation.

Table 9 Pound to Dollar and Krone exchange rate differences 2006-2008

	2006				2007				2008		
	jan	↕	june	↕	jan	↕	june	↕	jan	↕	april
NOK	11.82	-3%	11.44	9%	12.42	-5%	11.81	-8%	10.86	-7%	10.15
US$	1.77	3%	1.82	8%	1.96	2%	2.00	-1%	1.99	0%	1.99

Source: XE.com

The indirect effects of regulation are likely to be higher but cannot be identified in production cost models as the cost attributable to these variables cannot be isolated from market and exchange rate effects. However, these indirect effects of regulation on cost are discussed in the relevant sections below.

The difference in regulatory costs associated with environmental services reflects the differing overall approach to sector management in the two countries. Regulation of the Norwegian sector is the responsibility of its Directorate of Fisheries (DF) which requires companies to operate an integrated management system incorporating environmental management. Some costs to the company are therefore internalised and are not dissociated from general operation (although the analysis has attempted to do this). In Scotland environmental costs can be more readily isolated from general operation by companies and are then attributed to regulation. These are discussed in more detail under 6.6 on 'environment' below.

Raw materials (feed and smolt) are the two largest operational costs for salmon producers. While no regulation is directly related to these inputs for salmon producers, the potential for indirect

impacts of regulation through regulatory consequences for smolt and feed suppliers are discussed in section 6.4 below.

Overall regulatory costs on production account for only a small proportion of the difference in production costs between the three countries Other variables namely market requirements, economies of scale, exchange rate variation, and any indirect effect of regulation on input costs have a more effect on COP than the direct regulation of salmon production.

6.2 PLANNING

For all three countries 100% of planning costs were attributed to regulation. While some level of pre-assessment would be expected by companies in the absence of regulation, the reported costs relate to the specific regulatory information requirements.

If the large cost of the Norwegian licence is excluded as a user charge, planning costs across the three countries are broadly comparable and make up a similarly small proportion of total regulatory costs for Scotland and Chile (around 9% and 5% respectively).

In overall cost terms, there are very similar costs in addressing all regulatory requirements to achieve the planning consent for a farm site in each country. Based on a 10 year investment cycle, average costs under 'planning' (including EIA etc.) amount to £2,366/yr for Scotland, £2,629 for Norway and £2,035 for Chile. The small differences are expected to be the differing costs of in-house and third party services to undertake surveys for EIA purposes. However, as the average annual production capacity for a farm site differs markedly between the countries (taken as 1,250t for Scotland, 2,880t for Norway and 4,425t for Chile), Scotland is the most expensive on a per kg basis (0.2p/kg). There are therefore clear economies of scale for larger sites in this regulatory cost area as, while some costs are proportional to area (such as the Scottish planning application), other costs such as EIA are required at all viable scales of operation.

In this analysis it is assumed that planning costs are incurred and production goes ahead. In practice planning may be refused for a particular site, but this cost is still incurred by the company. Those surveyed in Scotland reported few refusals, as a consequence of pre-consultation identifying contentious applications early and enabling the avoidance of full planning costs. The level of uncertainty surrounding planning has less tangible effects on company investment and development strategy. These issues are discussed further in section 7 and are of particular significance for Chile where the large delays in gaining planning permission for new sites has resulted in expansion at existing sites, increasing the risk and consequences of environmental degradation and disease outbreaks.

6.3 BUILDINGS AND EQUIPMENT

In relation to the overall capital costs for building and equipment, the proportion attributable to regulatory costs are negligible for Scotland (1.4%) and Norway (0.03%) with none identified for Chile (0%).

In Scotland and Norway comparatively minor additional spend was identified for compliance with requirements for navigational markers and with the new regulation related to oil storage. In Norway additional regulatory costs are identified which relate to the requirement for all equipment to be certified to the Nytek standard. Although the standard is not deemed to be over and above industry requirements, a regulatory cost is incurred for receiving third party certification of compliance to that standard.

6.4 RAW MATERIALS

The two key inputs considered are feed and smolt, other inputs such as medicines are discussed under disease and food safety (6.7 below). At farm level, regulation can influence raw material inputs through controlling stocking density or the overall scale of farm and hence the amount of feed and smolt used; this broader influence on sector development is discussed in section 7.

6.4.1 Feed

Feed is the most important single cost category in production, accounting for between 50 and 60% of production costs in all countries and at all scales. Therefore any regulatory influence on feed costs is very important.

The total cost of feed is based on the amount of feed used and the price of that feed. The amount of feed used is dependent upon the Feed Conversion Ratio (FCR) which is influenced by feed quality, environmental conditions and technical expertise. While public sector support for R&D would play a role in technical capacity, regulation was not reported to have an influence on FCR.

Regulations are in place to ensure all food production inputs are safe for consumers. These impose costs on feed manufacturers and therefore have the potential to influence the price of feed. Differences in feed prices are identified between the three producer countries, but the influence of regulation on these price differentials is less evident.

All three countries operate under similar standards of control in relation to Genetically Modified Organisms (GMO), but Chile is not tied to EU directives in the same way that Norway, as a member of the European Economic Area (EEA) is required to comply with EU directives. Chilean producers are however driven by demands of its key markets of the US and Japan, which impose similar requirements to the EU.

The main difference in feed constituents is the use of feather and bone meal by Chile. Since the BSE crisis in the 1990's the EU has applied strict conditions to the use of land-based animal proteins, but the animal by-products regulations do permit their use. It is the EU customers that will not accept these animal by-products in salmon feed. Norway's key market is the EU and therefore is under the same market-driven constraints as Scotland, while Chile is not.

Chile has the cheapest feed cost due to its greater freedom in feed composition permitted by key customers and also by its proximity to the sources of all feed components; the Peruvian and Chilean fish meal and oil production; Brazilian and Argentinean plant oils and animal by-products.

EU buyers (multiple retailers) are also the determining factor in the level of substitution (vegetable protein replacing animal proteins) within feed. Here there is more differentiation between Scotland and Norway with Scotland's product perceived as being higher quality partly through a greater proportion of fish meal and oil used in feed formulation. When feed prices are compared between the three countries, not a like-for-like comparison as there is a market requirement in Scotland to use a greater proportion of higher cost feeds.

Research by the UK Competition Commission into the UK and Norwegian feed markets as part of the Nutreco and Hydro Seafoods merger concludes that "movements in relative prices largely correspond to exchange rate changes". [5] Other factors such as the volume purchased and transport logistics favour Norway in feed price as larger production runs and direct deliveries by sea will drive costs down. These variables, along with currency fluctuations, do have an

[5] http://www.competition-commission.org.uk/rep_pub/reports/2000/451nutreco.htm#full

influence on comparative feed prices, but it is market requirements that appear to have the greatest influence. No regulatory influence on feed price has been identified.

6.4.2 Smolt

As with feed inputs, the overall cost of smolt is determined by the amount used and the unit price. Again market forces have a key role in the overall cost of this raw material input to producers with economies of scale and differing requirements clearly evident between the countries. Unlike feed, however, regulation has been identified as having an influence on both the amount used and the unit price.

The Kontali Analyse figures from 2004 quoted in the stage 1 report show a large difference between Scottish, Norwegian and Chilean smolt costs per kg at 30p, 16p and 12p respectively. Updated statistics for 2006/2007 collected as part of this study show smolt costs from Norway decreasing further to 14p/kg and Chilean costs remaining at around 12p/kg. These changes are, however, predominantly the result of exchange rate fluctuations with a stronger Krone and a dollar that remained weak. The evidence for regulatory influences is therefore to a great extent masked by currency fluctuations.

The amount of smolt purchased by producers will be determined by production plans, which are influenced by expected mortality levels. It is understood that smolt production within the natural environment of freshwater lochs results in more robust smolt than enclosed production within tanks. Loch-based production can also be cheaper as larger scale operations are possible compared to land-based operations where capital investment is needed to try and replicate natural loch conditions.

Land-based smolt production enables tighter control and the potential for treatment of nutrients entering a water body, which supports the WFD objective of good ecological status. Recent regulation of the freshwater environment under the Water Framework Directive (WFD) is influencing smolt production costs, but it is yet to be seen whether hatchery production is favoured over loch production in Scotland, which is the case in Norway and increasingly recirculation systems are being introduced in Chile.

The fluctuation in Scottish salmon production over the last decade has resulted in fluctuations in the demand for smolt. In some areas there is an excess of smolt but in times of poor salmon prices Scottish producers have been unwilling or unable to invest and benefit from any surplus. These downturns lead to lower levels of smolt production in subsequent years and a shortage when producers have looked to increase production. This inevitably results in higher smolt prices for Scottish producers accessing a smolt production sector with limited capacity, whereas smolt production in Norway has matched the consistent long term growth of the sector.

6.5 STAFFING

The differences are mainly attributable to staff costs and wage levels (highest in Norway). Manning levels are higher in Chile than in Scotland or Norway, reducing productivity per employee and to some extent counteracting Chile's lower wage costs. The reported cost of regulation accounts for a small proportion in these total staff costs as companies suggest additional costs for training would be undertaken with or without a mandatory requirement to do so.

Some direct regulatory costs are however identified; these are largest in regulatory cost terms for Norway (22% of total regulatory costs) and relate to the regular reporting to government on the internal audit system required for all farms. It is evident that this relatively minor additional staff cost for Norway is far cheaper than the alternative approach taken in Scotland - the regulatory costs reported in other categories that are associated with monitoring and assessment by regulators.

For all countries, however regulatory costs associated with staffing are negligible, amounting to less than 0.1p/kg. In Scotland these relate to required training (boat handling, sea survival etc.) while in Chile they relate to the Ministrio del Trabajo where additional national insurance is paid based on the calculated risk to workers, which is around 3% of the farm workers' salaries.

6.6 ENVIRONMENTAL COSTS

There is a major difference in how costs relating to environmental reporting are considered across the three producer countries. Norwegian farms integrate environmental survey and monitoring into their internal management systems and therefore see most costs as part of good farm practice.

The management of a Norwegian farm includes the modelling of the seabed under the cages to ensure acceptable effects. A farm inspection by DF is undertaken at maximum standing biomass within the production cycle; this considers key aspects of farm operation including environmental impact. An additional small staff cost is identified for the monthly reporting to DF by companies. Overall there is an assumption of good farm practice and acceptable effects with an annual check to confirm the validity of reporting. Only when abnormal levels are identified an additional independent investigation is required.

In contrast to Norway, Chile and the UK report environmental survey and monitoring costs as external regulatory costs. Therefore, although this analysis has attempted to isolate environmental costs, some may remain aggregated within the Norwegian internal audit system. For Chile environmental costs amount to a few thousand dollars to pay for annual sampling by Sernapesca at the point of maximal biomass on site. For the UK environmental costs are second only to Crown Estate rent costs representing between 35% and 41% of the regulatory cost to producers (over 75% if rent is excluded from regulatory considerations).

UK costs are incurred through a combination of annual payments to SEPA, monitoring either in-house or by third parties and the employment of environmental staff to manage survey, monitoring and reporting requirements. Comparable staff and survey costs for third party surveys are identified for Scotland and Norway, but it is additional payments that represent a clear difference between the two countries. The Chilean regulatory system is closer to the Scottish system, but the overall cost is lower (0.1p/kg) due to lower wage costs.

There is a certain degree of self-regulation for UK operators, which results in a cost to the company for environmental survey and reporting, but companies also pay annual costs to SEPA for their regulation of the sector. This external management of one aspect of the sector is currently charged by SEPA based broadly on scale of operation rather than on performance, although this may change in the near future.

The additional regulatory costs resulting from this more precautionary level of survey and monitoring in Scotland may be an inevitable consequence of the more sensitive environment (shallower sites with less water movement) within which aquaculture operates in Scotland and may also to some extent contribute to the price premium achieved for Scottish product.

6.7 DISEASE AND FOOD SAFETY

The regulatory influence over disease and food safety is the most complex and difficult to quantify of all cost of production categories considered. It also contains one of the most important differences in the cost of production between the three countries: medicine costs.

Direct regulatory costs identified in this category are important for Chile (0.6p/kg accounting for 68% of regulatory costs), relatively minor for Scotland (0.1p/kg representing 2.5% of regulatory

costs) and are not identified for Norway (but contained within the costs identified for the internal audit system e.g. the monthly reporting of sea lice numbers). Regulatory costs under this category are made up of residue analysis costs and a proportion of vet fees from the requirement for qualified vets to administer medicines.

There is some discrepancy over the comparative price of medicine with some multi-national producers claiming a large price differential between Scotland and Norway (over 20% more expensive in Scotland). The pharmaceutical companies suggest this is simply a result of currency fluctuations and they could not charge different prices to the same customer. It is, however, recognised that the average scale of purchasing in the UK is smaller with orders in terms of numbers of sachets compared to the number of pallets of sachets in Norway, which may have some influence on price to the producer. There may therefore be some impact of discounts on volume purchases, but the main factor on unit price differences appears to be currency.

An important regulatory effect on the cost of medicines is the differing licensing regimes and approach to implementing regulations between Norway and the UK. Despite an agreement on the mutual recognition of fully licensed medicines being in place, Norwegian producers have historically enjoyed the use of newer and inevitably more effective medicines and vaccines compared to Scotland. With the far larger market for aquaculture pharmaceuticals in Norway it is inevitable that pharmaceutical companies focus on Norway ahead of Scotland. There has been a lag time of several years between Norwegian permitted use and UK permitted use, which appears to mainly result from an arrangement in Norway where use is permitted on an 'experimental basis' ahead of full approval. These temporary arrangements are not recognised under the mutual recognition agreement.

The need to incorporate chemical use within CAR licences adds further costs to the licensing process for Scottish producers. Technical variations to SEPA discharge licences amount to around 75% of the cost of the original licence, and this occurs on a site by site basis. As sea lice medicines are List II substances under the Dangerous Substances Directive, UK authorities must require that famers seek site specific licences for the discharge of these products.

For other food production sectors, when a medicine is licensed its use is permitted across the sector without the need for individual application. Because fish farms discharge chemicals within a water body, tighter controls based on individual applications are required. These efforts may also require additional survey and monitoring such as residue analysis resulting in costs to the Scottish farmer and there is some evidence that less precautionary controls are evident in Norway. Control of biocide application into the coastal environment is particularly important for Scotland with economically important crustacean fisheries (*Nephrops*, crab, lobster) operating in the vicinity of fish farms.

The differing environmental conditions in the two countries will account for some of the cost differences. Scottish production may be more susceptible to sea lice infestations as the country has comparatively shallower, more enclosed sites and sea temperatures similar to central Norway. But it is evident that some is due to Scottish producers being historically constrained by what they can use by comparison to their Norwegian and Chilean counterparts.

Resistance to permitted medicines means that they become less effective and a greater amount is required. Therefore in recent years Scottish producers have used a comparatively greater amount of medicines permitted for use in the UK, while Norway has used a smaller overall volume of a wider variety of medicines in a more effective way.

There are therefore direct costs in terms of the amount of medicines purchased and through reduced growth rate. The latter is widely reported, but difficult to quantify in isolation from other variables such as environmental conditions. Farmers in Scotland report around 6-9 p/kg

spent on medicines (which is consistent with this survey's 6.3p/kg); but Scottish farmers suggest the comparable spend for Norway is 4.5p/kg.

In the short term recent regulatory approvals and subsequent applications by companies will undoubtedly improve the competitive position of Scottish farmers. However the situation remains one of Norwegian producers being permitted to use new medicines several years ahead of their Scottish counterparts; this may well occur with new medicines and would present Norwegian producers with a comparative advantage. The benefits along with the risks of each country's approach need to be better understood and should relate to the specific circumstances in each country.

As the (currently anecdotal) 2.5 to 4.5 pence per kilo difference is greater than the total direct regulatory costs to producers that have been identified, this complex issue is of critical importance and requires further investigation.

6.8 GENERAL OPERATION

The 'General operation' category contains the subcategories 'rent' and 'insurance'. There is no statutory requirement to hold insurance and therefore no direct regulatory influence on insurance costs have been identified. However, once again the indirect influence of regulation inevitably affects insurance premiums. Premiums in the aquaculture industry are determined on a case by case basis but are thought to average around 3% of stock value (Hambrey, 2008). The relatively larger insurance cost is one of a number of factors discussed in section 7.

The second element considered under general operation is 'rent', which can be described as a user charge. In Chile a number of licences are required including a 'City Licence' and 'Concession Licence', but these are single fixed payments rather than a user charge based on production.

For Norway no annual rent is identified, but a user charge is evident; the production licence. For any new or expanded production a production licence must be purchased from the DF or from the owner of existing licences, although before 2001 licenses were simply allocated rather than sold. Assuming a 10 year return period, the investment in licences for a new site or for expanded production would correspond to around 4.5p/kg of production. In practice however, the licence is treated as a company asset which retains a market value (if production can continue in the area concerned). An alternative approach to converting this to a per kg cost would be to assume that the value of the asset (licence) is maintained, and to use the opportunity cost of the sunk capital – in other words the annual interest. On a licence cost of £400,000, and assuming an interest rate of 6%, this would amount to £24,000 p.a. or roughly 3p/kg. These costs do not apply to farms (production) established before 2001. Indeed these operations have in effect enjoyed an "asset windfall" in terms of the tradable value of their existing licences.

The large up front cost of the Norwegian licence would be a barrier to new entrants and may limit the expansion of smaller operators with less access to credit, but the result is ownership of an important asset for the company.

In Scotland rent is paid to the Crown Estate. The recent rent review resulted in rental charges that are tied to salmon prices (on the Rungis market). Rent is due at the end of the year following harvesting and is therefore based on real production. This contrasts with the Norwegian licence where the value is based on potential production.

Crown Estate calculations as part of the rent review identified a considerable NPV advantage for Scotland with the Norwegian licence cost equating to a 2.4p/kg charge each year compared to Scotland's 1.6p/kg. An alternative approach is to consider the amount of time at Crown Estate rent levels that it would take to pay the same amount as the Norwegian licence based on average

reported production levels of 960t/yr. On a non-discounted basis it would take 28 years to pay the equivalent amount at Crown Estate rent levels based on continual production from a site. A pay-back period of well over 30 years is likely with the inclusion of fallowing and discounting.

As the Crown Estate identifies, on a short-term cash flow basis Scotland is paying a lower user charge than Norway, but the Norwegian licence is treated as an asset and does not generally figure within the reported cost of production at farm level.

In Norway the licence fee goes directly to the body tasked with supporting the development of the sector. It could be argued that the Norwegian sector has paid upfront for much of the assistance provided by the Directorate of Fisheries – and indeed for some of the environmental management and monitoring costs incurred by government. In the UK, while the Crown Estate provides support to the industry in various forms such as the funding of the Scottish Aquaculture Research Forum (SARF), the government does not receive the user charge and yet is tasked with providing sector support. This results in less evident *quid pro quo* than in Norway where purchasers of a licence expect a service in return.

6.9 SUMMARY

- The direct costs of regulation (including all user charges applied to production) amount to 5.6p/kg for Norway, 3.7p/kg for Scotland and 0.9p/kg for Chile.
- Of the regulatory costs identified, user charges amount to 80% of regulatory costs for Norwegian producers and 47% of regulatory costs for Scottish producers. No similar user charge based on production volume is identified for Chile.
- Excluding the user charge shows that the direct cost of regulation in Scotland is 2.1p/kg. For Norway and Chile the costs of regulation are markedly less at 1.1p/kg and 0.9p/kg respectively.
- Other variables namely market requirements, economies of scale, exchange rate variation, and indirect effects of regulation on input costs have a greater effect on COP than direct regulation of salmon production.
- The user charge (Norwegian licence and UK Crown Estate rent) is a key cost to the sector (charged at 1.6p/kg for Scotland with an equivalent of between 3.0p/kg and 4.5p/kg for Norway). Chile has no user charge based on production volume.
- Only Norwegian production licences issued after 2001 were purchased by companies for the reported £400,000+ per licence. Therefore these costs to production would not apply to established farms.
- The different approaches to applying a user charge between Norway and Scotland each have pros and cons. Over the short to medium term the Scottish approach is cheaper and does not represent a barrier to new entrants as the Norwegian system does, but over the long term the Norwegian approach is preferential as the capital cost is lessened on an annual basis when spread over a longer timeframe and results in ownership of a company asset.
- Planning costs (other than purchase of the Norwegian licence) are similar across all three producer countries. The larger average size of production sites approved in Norway and Chile result in Scotland having the most expensive planning costs on a per kilo basis.

- Feed is by far the most important input cost, accounting for more than half of total costs, but no direct or indirect regulatory cost is identified as it is the market (key customers such as supermarkets) that dictates feed composition.
- Scottish feed costs are more expensive on a unit price basis primarily due to the formulation required by customers, with additional factors such as transport to farm, scale of production and proximity to (marine and non-marine) feed ingredient markets having a secondary influence.
- The cost of smolt is indirectly influenced by regulation with various environmental charges on freshwater operations (abstraction, discharge, impoundment etc.) associated with WFD affecting production and increasing the unit price charged to producers.
- Limited regulatory costs on staffing have been identified, but comparatively these are very small.
- Environmental costs are a major direct regulatory cost accounting for 40% of Scotland's direct regulatory costs. These are made up of a mixture of SEPA charges, mortalities disposal, third party and in-house surveys and monitoring. This is in stark contrast to Norway, which operates a greater degree of self-regulation and which has no environmental costs *attributed* to regulation. The efficient internal monitoring and regular reporting in Norway are integrated into the internal audit system. Chile has a similar approach to Scotland but with far lower costs.
- Disease and food safety regulation costs are of moderate significance in terms of direct regulation for all three countries, but are potentially the most important indirect regulatory costs to the Scottish industry. Medicines and associated costs appear to be between 2.5 and 4.5p/kg higher in Scotland than in Norway and Chile during the survey period. This cost difference is partly attributable to a stricter regulatory regime and lesser/later access to an effective suite of medicines, but other factors – such as environmental conditions and the incidence of sealice – are also likely to be important.

7 EFFECT OF REGULATION ON SECTOR DEVELOPMENT

7.1 DIFFERENCES IN REGULATORY REQUIREMENTS BETWEEN COUNTRIES

Section 6 identifies the greater self-regulation of the industry in Norway and the lower costs in Chile result in minimal levels of direct costs of regulation in these countries. While Scotland's direct regulatory costs are higher, they do not account for the large differences in COP compared to the other two countries. The indirect impacts of regulation on input costs play a more significant role. It is the indirect influence of the regulatory regimes that have had perhaps the greater impact on the comparative development of the sectors. Some of the main differences and the resulting impacts are explored below.

Appendix A presents a comparative table of legislation relating to aquaculture across the three countries, which illustrates the greater number of regulatory bodies that regulate aquaculture activities in Scotland compared to Norway and Chile. After the planning stage (where it is expected that a wider grouping of regulators and stakeholders are involved) the Scottish system has 5 regulatory bodies with responsibilities relating to aquaculture, Norway has 1 and Chile has 2.The complexity in Scotland is partly a result of Scottish devolution, attributing some responsibilities to Scottish Government while others remain at a UK level. Also in contrast to the legislature of Norway and Chile that addresses specific sectors including aquaculture, Scotland's legislation addresses issues and functions, resulting in separate legislation for water, environment, waste, etc. that must be considered by all sectors. The main contributing factor is, however, a result of the piecemeal development of aquaculture regulation to manage a sector that has for much if its development fallen between the remit of fisheries and agriculture departments rather than being recognised in its own right.

For Norway the importance of the sector justified the early establishment of an Aquaculture Act that has been regularly amended as the sector and associated issues have evolved. The later development of the Chilean sector has also enabled greater clarity on the structure and scope of legislation required to manage the development of the sector resulting in an all-encompassing "General Law on Fisheries and Aquaculture". However, the survey has not identified that the different regulatory structures between the three countries itself results in greater practical complexity (and additional cost) for the Scottish salmon farmer.

Scottish regulators maintain that there has been considerable streamlining of regulatory processes in recent years, that a substantial amount of support is available to industry and that the regulations that exist are justified. In practice, while the regulatory regime in Scotland could perhaps be further simplified (see section 7.6 below), a more important difference between the three countries is the type of regulators and their differing priorities that define their approach.

One key difference between the three countries is the licensing authority. In Norway it is the Directorate of Fisheries, in Chile it is Sernapesca that manage aquaculture licensing. Although consultation with local authorities and environmental agencies is required in both countries, ultimately the decision rests with the government body responsible for aquaculture. These agencies will have the knowledge and a vested interest in seeing the aquaculture sector develop. In Scotland aquaculture planning and licensing is the responsibility of local authorities. These do not have a specific remit or responsibility to "promote sustainable aquaculture" and are less likely to drive aquaculture development than a dedicated government department.

The likelihood of successful site development in each country has certainly affected historic development of the sector and continues to exert an influence. Anecdotal information gathered during the course of the survey suggests the number of intended developments not taken

forward due to objections in the pre-application stage or formal objections appear to be greater for Scotland than for the other two producer countries.

A recent research project studied the main issues that led to the rejection of 36 fish farm applications in Scotland from 1999 to 2004 (under all regulatory regimes, not only EIA regulations). Most were rejected due potential environmental impacts including those on the landscape, while 19% of the fish farm applications were rejected due to navigational concerns. (SARF, 2005).

Planning refusals in Scotland may be a consequence of a larger coastal population resulting in a greater number of users and interested parties in the Scottish coastal areas that are consulted and listened to in the planning process. In the long term this may result in a more sustainable industry as poorly sited farms are not approved, but it has inevitably hindered and frustrated the sector. In particular the planning process has resulted in constraint on expansion of existing sites.

The Scottish aquaculture sector inevitably blames the strength of the environmental and nature conservation agencies for the inability of the Scottish sector to match the economies of scale enjoyed in Norway and in Chile. To a certain extent the difference in average farm site may be a consequence of geography that means the shallower Scottish sites could not sustain the scale of production seen in Norway and Chile. The planning refusals and smaller average farm site could therefore be seen as evidence of an effective planning system favouring sustainable development.

Chile's rapid development shows evidence of a planning system that has promoted sector development, but in some ways has proved to be less effective than Scotland. It takes up to four years to get permission for a new site in Chile; expansion of an existing site is a less onerous process. This has caused the industry to develop existing sites, with the consequential economies of scale, but also an increased risk and impact of disease outbreaks. The recent ISA outbreaks have devastated the industry partly as a result of the scale and proximity of farms.

7.2 BENEFITS OF THE SCOTTISH SYSTEM

This report has identified a variety of direct and indirect regulatory measures that result in costs for Scottish salmon producers. While these additional costs are inevitably seen by the industry as a disadvantage, they should be viewed in the context of any resulting benefits. The main benefit can be defined by the comparative reputation of Scottish salmon and is evidenced by a clear price premium for the Scottish product.

According to French industry sources, the distinction between products bearing quality labels such as Label Rouge and those for the mass market will become increasingly marked. Therefore, processors wanting to buy high quality salmon will have to get used to paying higher prices (FAO, 2008). This suggests that the price premiums associated with Scottish salmon are likely to remain if the positive market perception of Scottish salmon is retained.

A strong regulatory regime is important to maintain consumer confidence and this does appear to be a factor in buyers' differing perceptions between EEA (Scotland and Norway) and non-EEA (Chilean) product. As this survey has shown the Chilean agency, Sernapesca, is now adding additional costs to the production process with residue testing etc. in an effort to improve the reputation of Chilean salmon and more regulation in this area is planned.

Within the EEA the differences in regulatory approach do not appear to influence buyer perceptions. All EEA buyers require a high level of confidence in the safety and quality of food products and there are numerous safeguards in place to ensure this. The Norwegian export agencies have gone to great lengths to show that there are indeed only perceived differences in quality between Scottish and Norwegian product. It is primarily the feed formulations etc.

(determined by buyer demands) that are maintaining these perceived differences in product quality between Scottish and Norwegian salmon rather than differing standards in regulation.

Scottish regulators have pointed to the success of tackling diseases such as ISA as in indication that strong measures are sometimes required to safeguard the Scottish environment and maintain the market premium for Scottish salmon.

The key considerations are therefore whether:

1. the present amount of regulation is necessary to maintain the positive market perception of Scottish salmon; and
2. the appropriate level of regulation can be delivered in a more cost-effective manner.

An assumed benefit of a strong regulatory regime is the potential for reduced insurance premiums. The study has not been able to identify evidence of regulation resulting in a comparatively reduced insurance cost between producing countries. Respondents were unwilling to discuss the details of insurance costs which are agreed between producer and insurer on a case by case basis.

Although the Scottish system has been identified as being in some regards more complex than Norwegian and Chilean systems, this should be considered against the need for regulatory compliance with European directives and also against alternative environmental management approaches that are applied to other sectors.

Fish farming is afforded a unique position compared to other production sectors in Scotland. SEPA inspects fish farm sites 1 to 3 times per annum with most sites receiving a single inspection. In human population-equivalent terms, fish farm discharges have a human population equivalent to 10,000 – 30,000 persons. Industrial or sewage discharges of this strength are likely to be visited by SEPA staff 12 – 24 times per annum. Fish farming therefore is only permitted to continue because its environmental impact is managed in a different way to other sectors. No other sectors are permitted to discharge what are effectively untreated effluent and various List II substances into a water body. A significant amount of public sector effort has been expended in developing models to ensure the sector is able to continue operating with the constraints of European environmental directives.

7.3 DISADVANTAGES OF THE SCOTTISH REGULATORY SYSTEM

Regulation is intended to manage economic operators without applying constraints that excessively hinder those operations. There will inevitably be situations where those operators feel they are constrained and government may also argue this is necessary to avoid unsustainable practices for short-term private gain. Hence what one stakeholder group will view as a disadvantage of regulation could be viewed by another group to be an advantage.

As mentioned above, the Scottish planning system comes under regular criticism from the industry. Many aspects are common to all three producer countries, but two key aspects of the Scottish system that sets Scotland at a comparative disadvantage are the specificity and the reactive nature of the planning process.

Box 2 The need for flexibility in licensing

Concerns have been expressed about speed at which the current regulatory climate allows companies to respond to commercial changes. For example, should a large supermarket require all fish to be produced at lower stocking densities (for example to RSPCA Freedom Foods Standards) a company would need 15% more net space – or be forced to reduce overall production by 15%. Even though the overall level of production remains the same (and within the existing biomass consent), the need for additional or larger cages would require a reapplication for planning, and a technical variation to the CAR licence as a result of new cage layout. A company might not be able to respond to commercial needs at the speed required by the customer.

The specificity of a Scottish licence results in **inflexibility** as most changes proposed by an operator will require notifications and will therefore be subject to additional delay. As producers must react to customer requirements promptly in order to retain customers, they are understandably frustrated when they are hindered in making technical alterations or efficiency gains that may well have other advantages. An example of this is presented in Box 2. While both Norwegian and particularly Chilean producers are also subject to planning processes of over 18 months for new sites, they would not be required to make licence adjustments if production volumes did not increase.

The other disadvantage of the planning system for fish farms has been its reactive nature. A planning system that highlights areas which are both suitable for aquaculture, and where conflicts with other interests or values can be minimised, would afford the sector greater confidence that proposed development will be looked upon favourably. It would provide planners with an objective evidence base indicating a site's suitability ahead of an interested party gathering that evidence. Norway illustrates that a proactive approach to aquaculture planning is achievable, although the more populous Scottish coastline would make this a complex task. Marine planning would also show that there has been wider consideration of all coastal users; a zone favouring aquaculture is less likely to be seen to disadvantage other coastal users as they should also be catered for and consulted in developing the plan. There are interesting examples of such approaches from New Zealand, Australia and many other countries. As things stand, the promoter in Scotland is faced with objections from parties that make equal or greater claim to an area.

Although there are attempts to develop a more pro-active approach to planning, it is now difficult to redress the balance. For example, the Sound of Mull Scottish Sustainable Marine Environment Initiative (SSMEI) is a pilot marine planning project that identified five possible areas which could be zoned for future aquaculture use. Of the sites nominated, four did not have suitable topography and the fifth was identified as an important horse mussel habitat. So, despite the areas general suitability for aquaculture, prospective sites that are acceptable to all parties have not been identified.

There is a prominence of environmental interests responding to the planning process. It has proved to be difficult and costly to appease these interests as there is a lack of information and consistency on what is acceptable in terms of impact. Again the absence of consideration of environmental capacity works against development such as that of aquaculture. Taking a precautionary approach at the application stage rather than at the stage of making the capacity calculation does make it more likely that the application will be refused.

The experience of Scottish salmon farms in planning contrasts strongly with Norway and Chile, where broadly speaking salmon farming is welcomed as a key element in the economy. In Norway the periodic government issue of production licences sends a clear message – *we wish to expand steadily and sustainably.* In Scotland gaining consent for a new site (or currently renewal for some existing sites) is seen as something of a lottery, since a company can ensure all the hard science is in place (water quality, benthic impacts, navigation) yet still fails to gain planning consent.

Compared to Norway and Chile, Scotland may be further disadvantaged in so far as the planning and environmental regulation of the sector is being undertaken by local government and specialist agencies (SEPA, SNH, FRS) whose approach is likely to be more precautionary than that adopted by a government department made responsible for promoting the sustainable development of the industry – as is the case in Norway (Directorate of Fisheries) and Chile (Sernapesca). Furthermore, the separation of responsibilities between different agencies without a common objective results in a lack of clarity for developers, potential investors and an atmosphere of uncertainty.

This situation, in combination with the sensitivity of the receiving environment, the sensitivities of stakeholders and the requirement of Scottish regulators to implement WFD, contribute to make the rapid development of aquaculture in Scotland less likely than Norway and Chile.

Finally, an important comparative difference in how regulatory regimes are applied relates to medicine licensing. Although Norway and the UK both adhere to the requirements of the EEA and have a mutual recognition agreement, in practice Scottish producers are disadvantaged. As section 6.7 suggests, this is a complex issue with some market influence, but may also be a consequence of how similar regulations are interpreted by the responsible agencies in Scotland and Norway.

7.4 SCALE ISSUES

A key question for the future evolution of the industry is the extent to which regulatory costs may differentially impact smaller farms compared to larger ones.

There are major economies of scale in the salmon industry. These relate primarily to labour, especially for sites of less than around 2,000 tonnes annual production. There are also modest economies of scale relating to smolt and feed costs. The extent of economies of scale in relation to these costs depend to a large degree on company structure and the extent to which company sites are clustered to create larger operational production units.

The impact of regulatory costs on farms of different sizes is more complex. Economies of scale in relation to monitoring and reporting are likely to be modest. However, those relating to planning and consenting procedures may be substantial. Larger companies typically have more resources and typically more existing sites, and strategic development can be relatively flexible, and adapt to regulatory uncertainties. Smaller companies may be committed to a particular location with fewer development options. Furthermore the costs of failure to achieve appropriate consents will be less easy to bear.

The high outlay on licence fees in Norway is also clearly a problem for smaller Norwegian companies with more limited resources wishing to enter the market. However, in so far as the licence is treated as an asset and effectively a right to farm, raising finance has not proved to be a problem in Norway.

The average farm sizes reported in the survey of 1250t for Scotland, 2,880t for Norway and 4,442t for Chile illustrate that the Scottish sector has been unable to exploit economies of scale. An obvious constraint here is the restriction in Scotland of discharge consent (CAR license) to a maximum of 2,500t allowable biomass (equivalent to around 4,000t production per cycle or 2,000t annual production). The uncertainty surrounding the approval for licence variations may also be a factor.

However, the nature of available sites in Scotland – often rather shallow if adequately sheltered and accessible – may constrain the size of individual farm sites. Image may also be an issue: some companies may wish to maintain a 'high value low volume' image in order to maximise the price premium enjoyed by Scottish product.

A combined strategy is emerging in Scotland where large scale producers focus production at sites that can be expanded. Smaller producers that are unable to expand seek a higher price through differentiating their product and focusing on the positive attributes of smaller scale operations.

7.5 DEVELOPMENTS IN AQUACULTURE LEGISLATION

7.5.1 Scotland

It remains to be seen how the Aquaculture and Fisheries Act (Scotland) 2007 will be implemented. It is likely that in the short term the role of FRS and the inspections currently undertaken by the Fish Health Inspectorate will be expanded to include routine inspection of farms nets, cages and possibly even moorings equipment to ensure the highest level of fish containment standards are applied across the industry. There will also be an increased requirement on the part of the farmer to replace pens, where necessary, to ensure that the highest standards of modern containment are in place. Similarly there is likely to be increased scrutiny, perhaps in the form of audits of net, mooring and pen maintenance and upgrade, and of procedures to be applied in event of escape incidents. The result may be a system similar to the Norwegian 'Nytek' standard, which Norwegian producers suggest is not excessive and is in line with good practice.

Aquaculture is exempt from a requirement for a FEPA licence under the Food and Environmental Protection Act 1985 (as amended). However recent operational practices – namely the use of well boats for sea lice treatment - have changed this. FEPA licences are required for deposition of aggregates from vessels at sea, and this same principle would apply to well boat treatments. This was initially prompted by complaints from harbours at the time of the ISA outbreak that well boats were discharging into harbours.

In the very near future FRS will alert farms to the need for a FEPA licence for well boat lice treatments. This will be a new and additional regulatory cost to farms – requiring time input for the application (similar to that currently undertaken to obtain a CAR licence from SEPA), and will require an annual fee. The fee is yet to be set but is likely to be in the order of £1,000 per year – although this has not yet been set so it is unclear whether the licence will apply per farm, per treatment, per company or per vessel. There will also be a delay – as any existing operation must stop, and the application will take around 8 weeks to process. Even with the additional cost of the FEPA licence, the use of well boats should still be cheaper than using tarpaulins for treatment.

The Crown Estate is also applying 'use it or lose it' incentives for inactive sites to stop potential blocking of competitors or other developments by doubling the charge for a non-productive site every 2 years, although the exact details are yet to be determined. There are issues of concern relating to this: fish farmers understandably wish to hold spare site capacity and flexibility so that they can respond to management needs and/or market demand. Furthermore, some companies have expressed concerns about the bio-security implications of letting other operators into an area.

As part of this survey companies occasionally expressed frustration that their efforts in improved environmental performance were not fully recognised. For example where companies had undergone accreditation to ISO 14001 standards, this did not influence the level of SEPA scrutiny. SEPA has raised the possibility of future annual discharge fees being partly determined by the historical environmental performance of the site with the results of routine SEPA inspections being used to determine the annual rate. This would essentially be an operator performance assessment, with consistent compliance resulting in reduced annual costs and vice versa.

7.5.2 Norway

International competitiveness considerations have together with environmental considerations been central in recent revisions of the Aquaculture Act and more specific regulations. Changes have largely been made in dialogue with industry representatives.

One can expect a continued strong focus on escape of fish from farms. Both at the ministerial level and at the Directorate of Fisheries it has repeatedly been stated that salmon escapes will have particular attention. It is difficult to see, however, that this will lead to the introduction of new regulations. Rather, one could expect more government resources to be allocated to monitoring compliance.

Although it may not be difficult to find individuals that are unhappy with specific parts of the regulation and its application by government bodies, there seems to be a general consensus that the regulations by and large facilitate a sustainable and competitive industry. An indication of this is that the Norwegian salmon sector has stabilized its share of global salmon farming production. Regulatory risk cannot be said to be an important limiting factor behind investments.

The Norwegian Government has repeatedly stressed that regulations should give confidence for companies' long term decisions. The limiting factor behind investments is rather the total ceiling on production due to the aquaculture licence system. One can also expect the government to follow a conservative policy with respect to new licences.

The Ministry of Fisheries and Coastal Affairs has proposed that a general fee for the use of public sea and land areas may be put before parliament in the future. Ministers have asked for an evaluation of such a fee, which has been termed an "area fee": it is, however, difficult to predict how likely such a fee is, when it can be implemented and how high the fee will be.

7.5.3 Chile

Currently environmental and sanitary regulations have no major impact on the cost of production. But with recent disease outbreaks and growing calls for tighter medicine controls these regulations are considered today as one of the most important points for the future development of the industry.

Even though new regulations or changes to existing laws have not been officially reported, modifications of the Ley General de Pesca y Acuicultura are expected regarding the following points:

- Regulations of egg imports
- Treatments of effluents (Processing Plant)
- Live fish transport (well-boats)
- Pharmaceutical product use
- Disinfection of solid and liquid waste (especially at harvest station)
- Redefinition of minimum distance between concessions
- Environmental survey (even though Environmental Consultant Companies mentioned that there are unlikely to be changes in the Reglamento Ambiental (RAMA)).

It should also be noted that some politicians have expressed an interest in claiming a 'royalty' from the different salmon companies. This royalty is yet to be discussed in detail but will probably be based on higher taxes and on stricter regulations to the industry.

In June, 2008 a large international campaign aimed at banning the use of antibiotics in aquaculture was launched in Chile. The project also demands that all sanitary standards regarding antibiotics for Chilean salmon consumers be brought in line with international standards, such as the United States' FDA rules or those of the European Union. Chile proposes a sole State

agency, which would regulate and monitor the use of antibiotics both in human use and animal health.[6]

The task of developing and applying new regulations will present a particular challenge for the Servicio Nacional de Pesca and especially Subsecretaría de Pesca. Application of new rules in areas where existing concessions apply – may prove particularly difficult. It will therefore be important that new and strong leaders from the industry help in this process and in many cases they will have to sacrifice companies' interests in order to benefit the whole industry.

7.6 OPPORTUNITIES FOR STREAMLINING THE SCOTTISH REGULATORY REGIME

Box 3 presents a number of areas where the Scottish Government and SEPA have already implemented changes or have identified ways to streamline the environmental regulation of salmon farming. The industry does recognise that many of these have resulted in efficiencies and improvements in their dealings with SEPA.

Box 3 Recent developments in the implementation of environmental regulation

Modelling

- The introduction of AutoDEPOMOD as a licensing tool, although requiring that farmers to undertake their own modelling assessments, has provided a planning tool to allow fish farmers to better assess where to develop a fish farm and improved confidence in the outcome of applications.
- Changes to the modelling approach for the bath treatment Excis (cypermethrin) has allowed farmers access to 2.8 x more Excis than in the past.

Monitoring

- Fish farmers are now expected to undertake seabed monitoring studies every two years (i.e. once per production cycle) rather than annual surveys.
- The monitoring of residues of in-feed sea lice medicines is being reduced from a requirement in each year used to once per two year growth cycle.
- An agreed approach for seabed surveys associated with new fish farms or revisions to existing sites has been adopted by SEPA and SNH to ensure that they meet the requirements of both agencies without duplication.

Applications

- SEPA, FRS and SNH now share responses to planning applications for fish farms before responding to local authorities to ensure that the content of the responses are not conflicting.
- SEPA has introduced a system to allow the electronic submission of seabed monitoring studies, increasing the speed of submission and improving the utility of the datasets.
- In dealing with applications for the new sea lice medicine based upon deltamethrin, SEPA took a decision not to require that such applications be advertised at sites where cypermethrin was already licensed, reducing costs and bureaucracy. SEPA also adopted a licensing approach for deltamethrin at such sites which did not depend on the submission of additional modelling data - reducing the costs and timescale.

Charging

- SEPA has introduced exemptions from subsistence charges for fallowed sites.

Source: D.Sinclair, SEPA Pers. Comm.

Some streamlining of the site licensing process has recently been implemented through the development of the Aquaculture EIA toolkit. However, it is unclear whether this development

[6] Fishupdate, 04/06/08

will deliver any reduction in regulatory costs for producers. The EIA toolkit may reduce the administrative burden for regulators and so reduce the length of time for the statutory agencies to respond to applications. But the planning system still requires the consideration of a wider group of stakeholders that will require information to address their concerns and no time gains in the process, despite faster responses from these statutory consultees.

It was beyond the scope of this research to examine in detail the relative cost-effectiveness of the more internalised procedures for monitoring and reporting in Norway compared with Scotland. Both approaches are ensuring a product that is suitable for the demanding and competitive European consumer market. However, in so far as these procedures have become increasingly standardised, the Norwegian model appears to be attractive. Furthermore, it has become associated with a different culture: these procedures are seen as standard good practice rather than as a regulatory burden.

This study has identified that there have been problems associated with uncertainty and the generally negative planning environment for fish farming in Scotland. Current planning uncertainty is also compounded by delay, especially where an appeal becomes necessary. An Expert Working Group on the siting of aquaculture facilities in Scotland (EWGS) is now proposing a more proactive approach to the location of new aquaculture operations, rather than an earlier expert working group that only focused on the relocation of existing sites to more appropriate areas. An assimilative capacity model has recently been developed that could inform the most appropriate location of aquaculture in the future. This work could, if carried forward in the strategic planning of Local Authorities, reduce the current planning uncertainties experienced by Scottish aquaculture developers.

Marine planning is an opportunity to remove future planning uncertainties, but this will require the needs of aquaculture to be balanced with those of the numerous coastal users also seeking recognition. Consequently wholesale expansion of the sector is unlikely to occur as only the most appropriate areas without existing conflicting users could be promoted.

Future strategic planning for the sector should determine where and to what extent particular forms of the industry should be supported; areas where there is the environmental capacity to support internationally-competitive high volume production and where lower-volume (but higher-value) production may be possible.

More specifically this study has identified that gains may also be possible in the regulation of environmental impacts and the licensing of medicines. The Norwegian internal audit system and subsequent reporting presents a lower cost approach to environmental management, although it is not clear whether such an approach would provide adequate protection to the Scottish environment. All Scottish operators recognise the need to maintain a healthy receiving environment and many have already implemented independently-certified environmental management systems (EMS). A greater degree of self-regulation in the industry may well be possible without causing additional risk to the environment. This deserves further specific study.

The licensing system for medicines in the UK is such that the length of time and costs involved prevent pharmaceutical companies from submitting applications for the UK market. Vet medicines are required to be licensed according to European standards within the UK; there is no such imperative in Norway or Chile. This puts the UK industry at a comparative disadvantage to a Norwegian system that facilitates the swift introduction of new effective medicines.

8 CONCLUSIONS

8.1 DIRECT COSTS OF REGULATION

- The direct costs of regulation (including all user charges applied to production) amount to 5.6p/kg for Norway, 3.7p/kg for Scotland and 0.9p/kg for Chile.
- Of the regulatory costs identified, user charges amount to 80% of regulatory costs for Norwegian producers (the cost of the Norwegian licence based on a 10 year return period) and 47% of regulatory costs for Scottish producers (the Crown Estate rent). No similar user charge based on production volume is identified for Chile.
- Excluding user charges, the direct cost of regulation in Scotland is 2.1p/kg, while for Norway it is 1.1p/kg and 0.9p/kg for Chile.
- Planning costs (other than user charges) are similar across all three producer countries and are not a major contributor to overall costs. The larger average size of production sites approved in Norway and Chile result in Scotland having the most expensive planning costs on a per kilo basis.
- No direct regulatory costs to producers associated with raw materials have been identified.
- Limited regulatory costs on staffing have been identified, but these are comparatively very small.
- Environmental costs are a key direct regulatory cost accounting for 40% of the UK's direct regulatory costs. These are made up of a mixture of SEPA charges, mortalities disposal, third party and in-house surveys and monitoring. Chile has a similar approach to Scotland but with far lower costs.
- Many of the environmental requirements in Norway are integrated with the mandatory internal audit system. Environmental regulatory charges are limited to one benthic survey and a small cost for the staff time required for the regular reporting to regulators. Limited routine monitoring is also undertaken (without charge) by Directorate of Fisheries personnel.
- For Chile most of this cost (68%) relates to charges under disease and food safety, particularly residue analysis.
- Environmental costs and charging appear to be significantly higher for the UK on a per kilo basis. This is again a consequence of economies of scale (as unit costs for surveys etc. are comparable between Norway and Scotland), but higher costs in Scotland also result from regulator charges and disposal of mortalities. Regulator charges are not currently influenced by performance, but this could be addressed in the future.
- Stricter environmental controls may be necessary in Scotland due to the more sensitive nature of some sites. It is also currently unknown whether this regulatory control may to some extent make a positive contribution to the price premium achieved by Scottish salmon.

8.2 USER CHARGES

- The user charge (the Norwegian licence and the Crown Estate rent in Scotland) is a significant cost to the sector in these countries. Chile has no significant user charge. Scottish rent is charged at 1.6p/kg of harvested salmon with producers charged based on actual production.

- Purchase of the Norwegian production licence represents a significant start-up cost (over £400,000 per licence with an average farm holding 5 licences). Based on a 10 year return period the licence amounts to 4.5p/kg on the cost of actual production. However only production licences issued after 2001 were subject to this charge, therefore these costs to production would not apply to established farms.
- The Norwegian production licence is of value due to the assumed future production permitted to the holder and is recognised by Norwegian banks as a tradable company asset, but this initial outlay could represent a considerable barrier to new entrants.
- Scottish producers are charged on the production they achieve, and a proportion of this is returned to help support or manage the sector. In Norway licence revenues also go to the government and there is an expectation from the sector that support to the sector is provided in return.
- The different approaches to applying a user charge between Norway and Scotland each have pros and cons. The Norwegian licence, as a tradable permit provides for both security (of production) and flexibility (to sell/rationalise). The Scottish system on the other hand is less expensive and less of a barrier to entry

8.3 INDIRECT COSTS OF REGULATION

- The indirect effects of regulation on salmon production may be more significant than direct regulatory costs, although it is difficult to dissociate indirect effects of regulation from the effects of other variables.
- Other variables namely market requirements, economies of scale, exchange rate variation, and environmental conditions all have a more significant effect on COP than differences in the regulation of salmon production between the three countries.
- Feed is by far the most important input cost, accounting for more than half of total costs, but no significant direct or indirect regulatory cost is identified. It is the market (key customers such as supermarkets) that dictates feed composition.
- Scottish feed costs are more expensive on a unit price basis primarily due to the formulation required by customers, with additional factors such as transport to farm, scale of production and proximity to (marine and non-marine) feed ingredient markets having a secondary influence.
- The comparatively higher cost of smolt in Scotland is primarily due to the scale of the production. Regulation has a less significant influence with various environmental charges on freshwater operations (abstraction, discharge, impoundment etc.) associated with WFD, that ultimately increase the unit price of smolt for producers.
- Disease and food safety regulation costs are of moderate significance in terms of direct regulation for all three countries. Scotland has comparatively higher costs associated with medicines - between 2.5 and 4.5p/kg higher than Norway and Chile. This differential is probably related to the amounts used, and their efficacy.
- Access to an effective suite of drugs appears to be more difficult in Scotland because of stricter licensing procedures than Norway and Chile, and this is seen by the industry as a significant factor contributing to these comparatively higher costs. These higher costs must, however, be considered against the wider risks associated with reducing licensing requirements in the UK and any benefits derived from a strict licensing system, such as the price premium.

8.4 EFFECT OF REGULATION ON SECTOR DEVELOPMENT

- Historically some characteristics of the Scottish regulatory regime such as its complexity and uncertainty (a 15 year licence with no guarantee of renewal) have hindered sector development through fostering a lack of finance sector support for the industry, which was in marked contrast to Norwegian banking support. These shortcomings in the Scottish regime were recognised and many of these aspects are being addressed, but the result is a smaller sector than in Norway and Chile. However, it should be noted that Scottish production in terms of fin-fish per kilometre of coastline is greater than Norway.
- Scotland is not exploiting economies of scale to the same degree as its competitors. Scotland's average site is estimated at 1,250t compared to 2,880t in Norway and 4,442t in Chile. Geography certainly plays a part in the potential size of Scottish farms with some sites being unable to support larger scale operations. However regulatory barriers may also have contributed to slow industry expansion including a comparatively reactive and inflexible planning system and restrictive operating conditions (e.g. licence specificity, discharge consents, etc.).
- Scottish salmon enjoys a significant price premium over Norwegian and Chilean product. Buyer requirements are most significant in maintaining that price premium; however the regulatory regime may make some contribution to maintaining Scotland's reputation. Any attempt to reduce regulatory burden and costs must not be at the expense of the product and sector's reputation.

8.5 FURTHER WORK

- The objective of this study was to identify and quantify regulatory costs in the three producer countries, not to make policy recommendations. In the light of this study's findings below are recommendations for additional work that may be further inform policy development.
- The key direct cost of regulation in Scotland (over 1% of total COP) is in the delivery of environmental requirements. This is in part a consequence of an approach that requires industry to survey and report, in addition to government agencies undertaking and charging for services.

Recommendation: Undertake a cost-benefit analysis of environmental regulatory requirements, assessing the charges and services associated with the aquaculture sector. Review alternative approaches to environmental management of the Scottish sector, including the use of a system-based assessment of environmental capacity and a higher degree of self-regulation.

- UK operators have been at a comparative disadvantage in medicine and vaccine licensing. There is an additional spend on medicines in Scotland compared to Norway reported to be 2p/kg to 4p/kg of salmon produced, which is greater than the direct regulatory cost differences between the two countries. Scottish salmon farmers were several years behind their Norwegian counterparts in the permitted use of new medicines. One constraint on Scottish production is that Scottish regulators are required to comply with EC directives. This is a highly complex issue that is currently informed by anecdotal information. There is insufficient information to quantify the various factors (environmental, market or regulation) influencing spend medicines in the three countries.

Recommendation: Although not a devolved matter, as Scottish producers may be being disadvantaged, further investigation of the veterinary medicine licensing regimes in Norway and Scotland is suggested. This may be through identifying efficiencies in the UK licensing process while ensuring continued compliance with EC directives and/or better market recognition of the safeguards in place for Scottish production.

- This study has identified that the indirect impacts of the regulatory regime in Scotland may be more influential to the higher COP identified compared to Norway and Chile. In particular a planning approach that is reactive and less supportive of sector development which prevents Scottish producers from achieving the economies of scale seen in Norway and Chile. This situation has been recognised with the establishment of an Expert Working Group on the siting of aquaculture facilities in Scotland (EWGS). An assimilative capacity model has recently been developed that would inform the appropriate siting of aquaculture in the future. This work could, if carried forward in the strategic planning of Local Authorities, reduce the current planning uncertainties experienced by Scottish aquaculture developers.

Recommendation: To ensure a more pro-active approach to aquaculture planning, the assimilative capacity model should be integrated into an aquaculture planning tool that can support site development or expansions.

- Industry consultation has identified that it is primarily buyer requirements that maintain the Scottish price premium through different feed formulations etc., but the extent to which other factors contribute to the Scottish price premium is poorly understood. For example, would the premium reduce if farms grew in scale to match those of Norway or even Chile?

Recommendation: Undertake an investigation of the market constraints on the Scottish industry, in particular the costs and benefits of enabling increased farm size.

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APPENDIX A – COMPARISON OF AQUACULTURE LEGISLATURE

SCOTLAND - Regulation	Regulatory Body	Planning: Access	Planning: Auth.	EIA	Marine Safety	Poll. Prevent. & Control	Fuel and Oil Storage	Waste and Wastewater	Special Waste	Packaging Waste	Transport of Waste	Disease Control	Animal By-Products	Feed	Duty of Care	Food Safety
Crown Estates Act 1961	Crown Estate															
Town & Country Planning (Fish Farming) (Scotland) 2007	LA															
EIA (Fish Farming in Marine Waters) Regulations 1999	LA (&FRS)															
EIA (Scotland) (Amendment) Regulations 2002	LA (&FRS)															
EIA (Water Management) (Scotland) Regulations 2003	LA (&FRS)															
Water Environment (Controlled Activities) (Scotland) Regulations 2005	SEPA															
Water Environment and Water Services Act 2003	SEPA															
Waste Management Licensing Regulations 1994 (as amended)	SEPA															
Env. Protection (Duty of Care) Amendment (Scotland) Regs 2003	SEPA															
Special Waste Regulations 1996 SI 1996/972 as amended	SEPA															
Pollution Prevention and Control (Scotland) Regulations 2000	SEPA															
Animal By-Products (Scotland) Regulations 2003	SEPA															
Controlled Waste (Reg. of Carriers and seizure of vehicles) Regs 1991	SEPA															
Water Environment (Oil Storage) (Scotland) Regulations 2006	SEPA															
Aquaculture and Fisheries (Scotland) Act 2007	FRS															
Fish Health Regulations 1997	FRS															
Food and Environmental Protection Act 1985	FRS															
Medicated Feeding Stuffs (Amendment) (Eng. Scot. & Wales) Regs 2003	FRS (VMD)															
Coast Protection Act 1949 (Merchant Shipping Act 1988)	MCA															
Marine Safety Act 2003	MCA, HSE															
Various IMO / SOLAS Regs. (*apply equally in Chile & Norway*)	MCA, HSE															
Health & Safety Regulations	HSE															

NORWAY - Regulation	Regulatory Body	Planning: Access	Planning: Auth.	EIA	Marine Safety	Poll. Prevent. & Cont	Fuel and Oil Storage	Waste and Wastewater	Special Waste	Packaging Waste	Transportation of Waste	Disease Control	Animal By-Products	Feed	Duty of Care	Food Safety
2005 Aquaculture Act																
FOR 2002-06-21 nr 686 - 2003 allocation of new leases	Dof															
FOR 2004-12-22 nr 1800 purchase of lease	DoF															
FOR 2004-12-22 no 1798 - farm establishment	Dof															
	Municipality															
	Food Safety Authority															
	WRED															
the NYTEK Regulations - equipment standards	DoF															
FOR 2004-12-22 no 1785 - tech, bio and env sustainable	DoF															
FOR 2004-03-19 no 537 Internal audit system	DoF															
FOR 2007-03-29 no 361 sanctions if the Act is violated	DoF															

CHILE regulatory regime																
Ley General de Pesca y Acuicultura	Sernapesca															
Ley de Medio Ambiente	Conama															
RAMA - Res Exe # 3411	Sernapesca															
Patente Comercial	Municipalidad															
Payment of Patente Unica de Acuicultura	Tesorería de la República															
Seguro Accidentes del Trabajo y Enfermedades Profesionales	Ministerio del Trabajo															
RAMA - Res Exe #3411	Sernapesca															
Programa Sanitario	Sernapesca															