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Regulatory Failure and Risk in Aquaculture: A case study of the Irish Oyster Industry

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Abstract

Globally aquaculture is seen as an increasingly important component in the quest to achieve food security in light of such drivers as a decline in capture fisheries, an expanding global population and climatic change. However, it is widely recognised that in many countries poor regulation acts as a major constraint on the development of the sector. This paper, using the Irish oyster industry as an example highlights not only how regulation can be seen as a significant source of risk in itself to aquaculture, but also how it also increases the level of other risks to the successful development of the sector. Mechanisms for increasing the resilience of the sector by dealing with these risks are reviewed and two possible approaches (supporting collaborative action and backing selected producers) to strengthening the structure of the industry are considered. Both approaches are shown to have strengths and weaknesses

Keywords Aquaculture, Risk, Regulation

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Introduction

Globally aquaculture is seen as an increasingly important component in the quest to achieve food security in light of such drivers as a decline in capture fisheries, an expanding global population and climatic change (FAO, 2014). At national and local levels it can also be a significant source of income and employment, often in economically disadvantaged (peripheral) rural areas (Jespersen et al, 2014). Whilst in Asia there has been marked growth in aquaculture, in many other regions it is failing to meet its potential (Jespersen et al, 2014; Knapp, 2012; European Parliament (EP), 2009; Howlett and Rayner 2004; Brummett et al, 2008).

Although several factors have been identified as to why the expected growth in aquaculture production has not occurred in a number of regions, a key feature has been a failure to overcome regulatory challenges (OECD, 2009; EP, 2009; Knapp, 2012). Many of the challenges facing aquaculture are similar to its land based equivalent, but its reliance on the aquatic environment adds another level of complexity. As noted by Van Houtte (2001) 'Aquaculture, in common with other food production activities, interacts with the environment, as it is dependent on land, water and aquatic species, and thus causes environmental change. Production must also lead to a product safe for human consumption by domestic and foreign consumers. Therefore its development and management is likely to fall within the scope of various legislations and the expertise of various institutions'

Nowhere is this more apparent than within the European Union where there are multiple governance institutions both at EU and Member State level. As the EP (2009) note 'At the EU level, for example, several DGs within the Commission have competence over some matter relating to aquaculture policy ... At the Member State level, policy, law-making and administration may be split not only across different sectoral bodies but also across different administrative levels (e.g. central government, regional government and local government)' They proceed to note that the 'obvious risk from the involvement of many bodies ... is that policies, regulation, administration and enforcement can come into conflict or overlap, or at least appear to do so.' EP (2009)

Beyond the EU, Nash (2004), Knapp (2012) and Howlett and Rayner (2004) highlight the challenges facing governance in a North American context. For example Knapp (op. cit) outlines five main reasons why the industry has failed to reach its potential within the US, a number of which relate to the regulatory environment. Most specifically, he argues that the governance system for leasing and regulation is structurally biased against US marine aquaculture (citing for example, an outright ban on fish farms in Alaska). In Canada, Howlett and Rayner (op. cit) provide evidence of the conflicts between federal and state regulations as well as regulatory barriers that range from the extremely hostile to more subtle challenges for the sector. Moreover, Hishamunda et al (2014) note there are 17 federal departments and agencies with responsibilities for aquaculture in Canada, in addition to departments of the 10 provinces. Brummett et al (2008) track the erratic development of the sector in Africa and again highlight regulatory difficulties as playing a significant role.

In terms of regulation as a perceived risk factor to aquaculture businesses, separate European studies have highlighted that regulatory risk ranked high amongst those faced by producers. For example, Ashan and Roth (2009) noted '...fish farmers perceive the risk of changes to different rules and regulations to be one of the most important risk sources for their business.' They also note that 'The risk of frequent changes of policy and thereby regulations on their production poses a high risk

for continuity'. Similarly Bergfjord (2009) found that 'institutional' risk factors (market regulation, area access, changes to licensing system, environmental regulations or animal health regulations) were viewed as highly significant by fish farmers in Norway.

Whilst regulation as a risk factor has received some attention in the literature, few studies have examined how it interacts with other risks identified as being important for aquacultural producers. Against this background, the purpose of this paper is twofold. First, it aims to provide a clear example of the significant impact regulatory failure has on the development of aquaculture within the context of oyster production in Ireland. Second, it highlights how regulatory failure often exacerbates the risks that producers face and reduces their ability to either prevent, mitigate, or cope with these risks. Based on the analysis the paper considers how improved regulatory structures may enhance the resilience of the sector enabling it to deal better with these risks and to take advantage of the opportunities that exist.

Irish oyster production is chosen as a case study because it represents a microcosm of the global situation. Ireland has a number of advantages in terms of its physical geography for the production of oysters. These include a suitable climate and a large number of coastal sites suited to oyster production. This means that, in physical terms at least, it could support a major growth in the industry. In addition, significant market opportunities exist, particularly in Asia. This has led a number of recent high profile reports to highlight the potential for significant growth in the Irish aquaculture sector and the contribution that it can make to food production and economic development in rural areas of Ireland (for example see *Harvesting our Ocean's Wealth*, 2012; CEDRA, 2014). Vega et al (2014) and Renwick (2015) highlight the potential economic gains from achieving growth in the sector, however, the oyster industry continues to face significant regulatory challenges that interact with financial and biological threats to constrain growth.

The paper is structured as follows. The next section provides a brief overview of the current structure and economics of the oyster sector in Ireland and outlines the history behind the current challenges with the oyster production licensing system in Ireland. The methodological approach is then outlined and this is followed by presentation of the results. Next, the discussion section draws on the findings to consider possible measures and overall strategies that could increase the resilience of the sector. Finally, some conclusions are drawn.

Background to the Irish Oyster Industry

Oyster production in Ireland can be viewed as both an old and a new industry. Old, because there is a long history of the harvesting of native oysters in Ireland. New, because the commercial farming of Oysters (mainly *Gigas*) is much more recent, beginning mainly in the 1980s and 1990s.

Total production of Oysters was estimated to be nearly 9500 tonnes in 2014 (BIM). With the exception of 2012, where there were particular problems along the West coast due to an algal bloom, production has grown steadily and was 28 per cent higher in 2014 when compared with 2010.¹ Oyster production occurs in 11 counties in Ireland, however, two counties, Waterford and Donegal, together account for around 60 per cent of Irish production in terms of tonnage.

In general Oyster farming is small scale in nature, for example seventy-five per cent of enterprises had five or fewer employees. However, it is estimated that as much as 70 per cent of Ireland's production comes from just 15 enterprises (BIM, 2012). In 2014, an estimated 1,200 people

¹

attained some form of employment (equating to 551 full time equivalent (FTE) positions) from Oyster production, reflecting the labour intensive nature of the enterprise. this. In line with the growth in output, total employment (in terms of FTEs) increased by 20 per cent between 2010 and 2014.

The value of production has grown significantly in the last few years reaching just over €40 million in 2014, a near doubling of the 2010 value. A combination of significantly higher prices as well as increased production are responsible for the growth in output during this period. The Irish industry benefited from a series of events in France that led to a significant reduction of domestic supply and a marked increase in the price of Oysters (Girard and Pérez Agúndez, 2014). Retail prices in France rose from just under €8 per kilo in 2009 to nearly €12 by 2013 and this change was reflected in wholesale prices in Ireland.

A key feature of the Oyster industry is that it is export focused with the vast majority of production being consumed outside of Ireland. Globally, the Oyster industry is dominated by France and this is the major destination for Irish exports, accounting for an average of 88 per cent of exports between 2012 and 2014. Much smaller quantities are exported to other parts of Europe including the UK and the Netherlands and to markets in Asia. The influence of France goes beyond being the main market for Irish oysters. French producers are heavily involved in production in Ireland. Anecdotal evidence suggests that around 25 per cent of production is undertaken directly by French producers with another 25 per cent produced ostensibly by Irish producers but under direct contracts to the French. This suggests that either directly or indirectly French interests control around half of Irish production.

According to EU figures, there was a transformation in terms of profitability of the sector over the period 2008 to 2012 in line with the strong prices being received from the main market of France. Gross Value Added increased from around 5 million to nearly 30 million and in terms of Net Profit the sector moved from a loss of 6.4 million in 2008 to a surplus of 18 million in 2012. Although detailed financial figures are not available for 2013 and 2014, given the increased output, this trend in profitability is likely to have been maintained.

Taken at face value, it may appear that the industry is one that is currently thriving with output, employment and profitably all increasing markedly in recent years. However, these aggregate figures hide considerable variation in performance between years both across regions and within particular businesses. It also fails to take into account the possible constraints on growth and their impact.

A key issue within the Irish Oyster industry in the regulatory environment within which it operates, in particular, the dysfunctional nature of the licensing system (for example see IFA, 2014). Box 1 briefly summarises the background to the complex licensing issue.

Box 1: The licensing issue

Initially as the oyster farming industry began to develop (in the 1980s and 1990s) licenses were allocated and the industry began to grow on the foreshores around Ireland. Problems began because under EU legislation (and in particular directives such as the Birds and Habitats Directive²) each country had to designate a certain proportion of its land area as conservation areas. However, due to the characteristics of the Irish landscape (for example, the low levels of forest cover), it was a challenge for the Irish Government to reach the required level of designation. This led to a delay in designating areas, which in turn led to the situation where they were facing daily fines from the EU for non-compliance. Under this pressure the decision was made to designate large areas of the foreshore as Special Areas of Conservation (SACs). Whilst this was a short term solution to the immediate problem it had major implications for the oyster industry. The difficulty was that licenses to operate had already been issued in these areas and the industry had developed. Environmental groups argued that these licenses did not take proper account of Natura 2000 requirements and that the Irish Government were delinquent due to the fact that this was an infraction of the rules. The European Commission agreed with the Environmental groups that the Irish Government had not followed the proper procedures. In December 2007, the Court of Justice of the European Union ruled that Ireland had not complied with the Habitats and Birds Directives by not requiring appropriate assessment of aquaculture activities in or adjacent to Natura 2000 areas. By extension, the judgement also impacted on Ireland's licensing of fisheries in such areas. The judgement relating to aquaculture was one part of a larger judgement relating to implementation of the Directives by the State and this meant that in December 2007 the licensing system came to a grinding halt.

The required procedures meant that within the designated areas there was a need to carry out an Appropriate Assessment (AA, under Article 6), but in turn, an AA required that, for each area under consideration, Specific Conservation Objectives (SCO) had to be set. However these were non-existent as the underlying baseline research had not been undertaken – for example the undertaking of habitat surveys. Therefore to begin to rectify the situation these three steps had to be followed. First, there was a need to undertake baseline research; second SCOs could then be set and; third, based on these an AA could be undertaken which could assess the environmental impact of oyster farming against the SCOs and see whether or not it maintained favourable conservation status. The main problem is that this is a very time consuming procedure and, in part due to the economic crisis of 2008, there have been relatively few resources to undertake this.

However, the problem was that many of the licenses were issued under the 1997 Aquaculture act (which was amended in 1999) and these were for a duration of 10 years only. Therefore they began to expire, but new licenses could not be issued as the above environmental procedures had not been completed.

The problem was recognised and, as a fix, Section 19A4 to the 1997 act was introduced. This stated that if an operator had a license under the 1997 act and had made an application to operate, then they could continue until the proper procedures had been completed. However, this was not a license as such. So while they could produce they had weak property rights over production.

² The environmental directives were later collectively known as Natura 2000

Method

The study involved both primary data collection and detailed analysis of secondary data. More specifically the approach adopted involved:

- A review of relevant literature
- Compilation and analysis of available statistics
- Semi-structured face to face interviews with 11 oyster producers from across Ireland
- In-depth interviews with industry representatives

The interviewees for the study were chosen from a list of producers provided by the Irish Shellfish Association, the main body representing Irish oyster farmers. From the list provided, the selection process was weighted towards the larger producers (who account for the bulk of Irish production) but did include smaller producers as well those involved in traditional native oyster production to ensure a range of views were captured. In addition, the interviewees were selected to reflect the geographical spread of oyster production across Ireland. The interviews were undertaken during the summer of 2015. Altogether 14 producers were contacted and all agreed to participate, however, due to logistical challenges associated with scheduling visits, only 11 farms were in the final sample. Whilst individual production levels vary from year to year, the selected farms together account for roughly a third of the overall production in Ireland. The interviews covered the following general areas: economics of production; ambitions for growth; possible constraints to growth; the regulatory environment; environmental concerns; collaboration and co-operation and; the role of research and development.

The approach adopted here differs from a number of studies that have been conducted on risk in agriculture, and the relatively few that have been conducted in aquaculture which have used a relatively standard questionnaire to assess views on the importance of risks on a likert scale (see for example Meuwissen et al, 2001; Bjerkeret, 2009; Ashan et al, 2011). This study is more qualitative in nature and the issues are drawn out through a semi-structured interview around the development of the business and its opportunities and constraints. Whilst this does not formally 'quantify' the extent of the risks, it allows for a deeper understanding of the business and the strategies adopted to deal with the risks. It also allows for more detailed exploration of how the various risks interact.

Results

The review of the literature and the interviews with industry experts and producers led to the identification of a number of key risks (Table 1) in addition to those that emerge from the uncertain licensing environment. Whilst there are a number of ways that risks facing primary food producers can be classified (see for example Harwood et al, 1999; Meuwissen et al, 2001; OECD, 2010), for ease of exposition, the risks identified in this study are broadly classified into regulatory, financial (including market) and biological risks. The risks within the individual categories are and the nature of the interaction between regulatory and other risks is presented.

Table 1: Summary of key areas of risk to oyster businesses in Ireland

Classification	Examples of Risk Source	
Regulatory	Dysfunctional licensing system	Land (water)-use conflicts
	Excessive number and lack of co-ordination between regulatory bodies	Disputes with environmental and other interests
Financial	Over-reliance on French market	Commodity production (volatility)
	Lack of capital	French control of production
Biological	Toxins (algal blooms etc.)	Viruses (herpes etc)
	Food Safety (Norovirus Ecoli etc)	Environment (storms etc)

Regulatory

Across all the interviews, the licensing issue was consistently highlighted as the greatest threat to oyster businesses within Ireland. This is because, as one producer explained: ‘Licenses are the engine of the whole business.’ Many of the farmers were still struggling either to get their original licensed areas legitimised or to get new licenses. The level of frustration felt by producers when trying to resolve their licensing problems was summed up by one producer: ‘We deal with storms, we deal with market collapse, we deal with mortality, we deal with all these things, but for some reason these all pale into insignificance compared with the frustration with dealing with the State.’ The constraint that lack of licensing placed on the growth of businesses was often mentioned: ‘I think it [the business] could grow and would grow drastically if the licensing issue was sorted.’ Beyond individual businesses it was also seen as detrimental to the wider development of the industry: ‘The whole licensing situation is destroying the industry, hanging there for years and years.’ Part of the frustration of producers emerges from a strong feeling that they are not included in the discussions over regulation of oyster farming: ‘The fact is they won’t talk to us, the government departments won’t talk to us ...’

The extent of the problem and the level of frustration has begun to manifest itself in a deeply embedded distrust of the licensing and other authorities. One respondent’s view, although somewhat extreme, illustrates a general feeling expressed by a number of those interviewed: ‘The Department of Marine would rather there was no aquaculture.’ In the absence of secure property rights, oyster farms have adopted a pragmatic approach to dealing with the licensing problem and continued to grow their businesses, but it is recognised that this is not without risk to the business. The problem is highlighted by the dilemma facing one farmer: ‘It is like Catch 22 - they haven’t done anything with the license so haven’t come near us so we are fine, but now they are looking at it, that is good, but then they are going to tear strips off us.’

An interesting knock-on effect of the licensing hiatus is that it has actually led to increased numbers of license applications, which has exacerbated the problem for the licensing authorities trying to work their way through the backlog of applications. This has emerged because fear of other producers getting licenses in prime bays has led to ‘block’ applications for licenses. Under the regulations once a license is applied for on a particular site for then no activity can be undertaken on

the area until the application has gone through the process. Therefore, by applying, producers effectively block others from that area.

As noted earlier, a particular challenge for aquaculture is the number of bodies at all levels of government that have a regulatory interest in the sector. Irish aquaculture is no exception to this with one producer noting that in the bay they were operating there were: 'thirteen bodies responsible for the bay.' To farmers the problem is not just the sheer number of regulatory bodies, but the fact that: 'They [Government bodies] don't talk to each other.. that is what I find is a major problem in the industry.. I have to deal with five government bodies rather than just one.'

Another dimension of regulatory risk is that the sector is particularly susceptible to wider decisions made as to land use and infrastructure within Ireland. For example, poorly functioning waste treatment infrastructure, lack of planning control and attempts to alleviate flooding problems further inland (such as the draining of rivers) were all seen as posing a threat to oyster production: 'The quality of water has deteriorated in the last couple of years and [the] ... county council are the biggest threat, they need to understand the consequences of what they do inland and the effect on water quality.'

In addition to conflicts around the use of water, the nature of Oyster production has led to disputes in some areas with environmental groups and other users of the foreshore, in particular leisure users. This arises because of the need for access to the foreshore for tractors and workers and the placing of trestles to tether the oyster bags. Whilst some producers have sympathy for the concerns expressed by the environmental lobby, many were highly sceptical of the claims made as to the possible negative impact of oyster farming: 'I don't believe we are having an impact on birds as we are not destroying their natural habitat.. I don't think that a tractor and trailer working on the beach disturbs them.' This in part stems from a strong feeling that oyster production has minimal impact: 'If we were to remove them [the trestles] tomorrow everything would be exactly the same [as before we started farming]. Further, environmentalists have raised concerns about the fact that pacific oysters are not native to Ireland and that they are spawning and becoming an invasive species. Again this is contested by producers: 'I don't believe pacific oysters are breeding... it is a load of waffle. The water is too cold and if they were then we would be doing it ourselves and collecting the seed.'

Of course, perceptions as to the extent of the intrusion on the landscape and the impact on the environment vary (Hynes et al 2014; Murray and D'Anna, 2015)) and the issue has become highly charged with a number of high profile disputes occurring in Ireland. Again licensing may be seen to exacerbate the problem as uncertainties around licensing and hence property rights has led to the existence of potential 'grey areas' of production which in turn increases tensions around competing uses of the foreshore

Financial Risk

While oysters may generally be perceived as a luxury item, production in Ireland has actually developed along traditional commodity lines with the product generally exported in a bulk form with little value added. For this reason the oyster sector in Ireland is susceptible to the usual vagaries of commodity markets and the producers recognise the problem: 'Price of bulk oysters collapses, big incentive to just get rid of them... someone stuck with 500 tonnes has to get rid of them.' This susceptibility is enhanced by the combination of a high level of export dependence and that nearly all these exports (just under 90 per cent) are to one market, France. Growers are well aware of the risks associated with this reliance on the French market in general and a limited number of buyers in

particular: 'That is grand but when the French don't want them what do you do then. November, December what ... are we going to do? ... [they said they would] buy a tonne here and there but only half came back.'

Whilst there is an understanding that improved marketing has a role to play in reducing the reliance on the French market, some producers see this as challenging: 'There is this idea in Ireland for years that we need to brand our own and it is good... As first generation [oyster farmer] I have all the work cut out for me to do. It is an entirely different job, it is a marketing job not a farming job.' On the other hand others argue that marketing should be seen as having primacy: 'I see it differently from many people who were on about production, production, production and no word about marketing ... there is no point producing something if you have no market'. Many though recognise the difficulty of breaking the French stronghold on oyster brands: 'We do all the work, they [the French buyers] don't do anything. They wash it, they put it in a nice box and re-export as French. But the reality is that the world connoisseur market wants French Oysters. That is the perception the whole perception of French food and that is what you are fighting against.'

A number of those interviewed for the study saw a lack of capital investment as a risk for their businesses (as well as a constraint on the overall growth of the sector). Whilst a number of reasons were cited for the inability to obtain capital, producers saw the licensing issue as being a key factor. Unlike in farming where the producer owns the land, in oyster production the license is often the main security that producers have. With no license in place, it is hard for a business to raise capital – for example from banks or from outside investors. In addition, due to Irish legislation, if a producer does not have a license they are not able to access EU, or national, rural and other business development grants. This places Irish producers at a disadvantage when compared to their French counterparts for example. As one producer highlighted: 'Most things flow from that [licensing problem]...for example expanding and putting in purification ... first thing the bank are going to ask you for is your licence...what are you going to say? Oh sorry it ran out 2 years ago!' Another producer succinctly reiterates this point: 'The banks are not going to give you money to throw into the sea.'

The interviews with industry experts highlighted a concern that there was a lack of innovation in the oyster industry with production techniques not having developed significantly since the industry was established. There was a fear that this could impact the long run competitiveness of the sector. In discussion with producers, the uncertainty of licenses was seen to negatively impact on innovation because businesses were either unable or unwilling to invest in new systems or processes. Producers also stated that even where licenses were in place they could stifle innovation, because the license specifies the system of production to be followed. To change the system of production (for example through adoption of new technologies) would require a new license meaning producers would get caught with the whole licensing problem again.

Biological Risk

The biological nature of oyster production and the fact that they are often eaten in their raw state were identified by the interviewees as leading to a range of other risks for producers. These included risks to the oysters themselves (eg increased mortality in seed through viruses or Algal blooms) and risks to those who eat oysters (due to toxins or noroviruses etc). Failure to deal with the biological risks was seen to either lead to a reduction in productive capacity or to a loss of markets due to food safety breakdowns. Food safety issues, whilst rarer than production problems, tend to be high profile and potentially damaging to the industry. For example, an outbreak of

norovirus in Hong Kong in 2012 led to the banning of Donegal oysters from that market. In terms of the business the impacts of a failure to cope with the biological risks can clearly be very severe in nature as one producer explained: ‘...sales were a little bit down don’t know why then seed died and then we had product recall over norovirus all within a space of six months and that nearly wiped us out - took two years to recover. ‘

The interviews highlighted that oyster farmers have adopted a range of approaches to deal with these threats, some more basic than others. For example, a common approach adopted in response to the high seed mortality levels due to the herpes virus was simply to increase the quantity of seed put out. Other approaches have been to pay more for seed from sources that is less likely to be infected and in some cases all producers in a bay have informally worked together to try and keep viruses out of the bay by agreeing to all source their seed from safer sources.

The interviews highlighted how the licensing issue increased the exposure of oyster businesses to biological risk both directly and indirectly. The direct impact emerges from the fact that the restrictive nature of licenses (in terms of where and how production can occur) means that it is harder to move stock out of harms way from biological threats (for example algal blooms). Indirectly, as noted above, the difficulty in raising capital or attaining grants without secure licenses mean that firms may be unable to invest in systems that may reduce the risk of food safety breakdowns (e.g. improved purification systems).

Discussion

Vulnerability

Having outlined some of the key risks faced by the sector, it is necessary to consider further why the sector may be particularly vulnerable to these risks. First, and most obvious, is the issue of uncertain property rights. As farms need a license to produce they are vulnerable to dysfunctional licensing system. Second, many of the firms are first, or at most, second generation. Therefore they have not accumulated much capital in the business and much of what has been generated has been reinvested so there are very little ‘reserve’ funds to help deal with negative shocks. This means there is relatively little capability to deal with the risk compared to the level of vulnerability (Leat and Revoredo, 2011). Third, in general, even the larger businesses in Ireland are relatively small scale and the overall size of the industry although significant is still small. The scale and fragmentation of the industry makes it hard for individual businesses and the sector to benefit from economies of scale. This is particularly the case in areas which incur relatively high fixed costs for producers such as investment in purification, wider food safety and quality assurance requirements, logistics and marketing efforts. Fourth, the inability to gain grants make it harder to develop purification and packing facilities and therefore make the industry dependent on the French market. Finally, a current weakness in the sector is the lack of mechanisms (for example through regulatory flexibility, financial aid or fully functioning insurance tools) to help producers deal with “force majeure” situations (for example mass mortalities caused by extreme weather, disease or algal blooms).

The results highlight a sector that is vulnerable to a range of (inter-related) risks which are constraining its development and that regulation is at the heart of the issue. At one level, it is possible to consider how through the use of specific measures the individual risks may be prevented, mitigated or coping mechanisms developed. However, a broader issue is whether more fundamental changes to the structure of industry are required to make it less susceptible (more resilient) to the risks that remain and if so how such structural change could be achieved.

Risk Management Options

In terms of considering the risks individually, Table 2 highlights that there are a range of potential measures that may prevent, mitigate or help the industry cope with these risks. The table is not meant to be exhaustive in nature but more illustrative of the types of measures available. Whilst they are presented separately there are also a clear links (often with feedback) between many of the measures. For example, insurance mechanisms that could reduce financial losses from disease outbreaks may also make the industry more attractive to outside investors, increasing the capital in the sector which in turn could be used to improve biological control and reduce the risk of disease. In relation to the focus of this paper, similar links can be seen between resolving the licensing issue and addressing a number of other risks faced by the sector. The table also highlights that there are significant roles and responsibilities for both the public and private sectors (individually but often collaboratively) in implementing the measures.

Table 2: Potential Risk Management Options for the Oyster Industry

Risk	Examples of Options (Prevention, Mitigation, Coping (P,M,C))*	Responsibility Public /Private Sector
Licensing	Invest resources in making sure of EU compliance (Natura 2000 etc). Develop 'One stop shop' to speed up and simplify application process P)	Public
Lack of co-ordination between regulatory bodies	Co-ordination of regulation (M)	Public
Reliance on single market	Purification/diversifying markets/branding (M, C)	Private and Public
Lack of capital	Secure Property Rights (tradable licenses) (M)	Private/Public
Land-use conflicts	Marine Spatial Planning (M), Enhancement of CLAMS type models	Public/Private/Third Sector
Environmental	Use of Triploid seed to reduce threat of spawning (M)	Private
Volatility	Purification/diversifying markets/branding (M, C)	Private/ Public (e.g. encouragement of co-operatives)
Toxin (Algal Blooms etc)	Insurance (C) / License flexibility (C)	Private/Public
Food Safety (Norovirus, Ecoli etc)	(Cause) Improved water treatment infrastructure, planning (P)	Public (Irish Water, Local Councils)
	(Symptoms) Improved purification processes (P)	Private Public (Research funding)
Viruses (Herpes etc)	Insurance (C) / Improved biosecurity (P)/ Develop domestic seed production (M)	Private (biosecurity measures etc) Public (support seed development, underwrite insurance etc)

Notes: *Prevention: Measures designed to provide permanent protection or reduce the likelihood or intensity of a hazardous event so it doesn't become a disaster. Mitigation: Measures taken to respond to and manage a hazardous event. These measures prepare businesses to act appropriately before, during and after the event. Coping: Measures taken to minimize the adverse impacts on the business after a hazard has occurred

It should be emphasised that the licensing problem is not simply an Irish one. As the EC (2012) note 'It is clear that several of the key constraints relate to the licensing procedures employed in the Member States. One of the problems is simply inconsistency – different procedures and approaches apply not only as amongst Member States but also within Member States individually. There are also common problems in how licensing is carried out – there are typically multiple agencies involved; there is often a need to obtain more than one licence or permit; the application procedures are not joined up, may take different lengths of time and, cumulatively, the entire process can take several years; the outcome of applications is unpredictable; and licences are not issued for sufficient periods to promote certainty and investment reliability' (EU 2009). However, whilst Ireland is not alone within the EU, the licensing difficulties are at the extreme end of the spectrum.

The requirements of a functioning licensing system are well recognised. For example in a study for the FAO it is noted that 'The purpose of licensing is to ensure an orderly development of the industry with due care taken to minimise negative externalities' (Hishamunda, 2014). The Irish Government's view is that this is what is happening: 'The regulatory procedures in respect of all aquaculture activities have never been stronger and represent a good balance between the need to develop the Industry and provide the highest level of protection for our marine and coastal environment.' However, as the interviews highlight this is clearly not the perception of those within the industry.

Examples exist within Europe and elsewhere of licensing systems that appear to be functioning more effectively. For example, Norway is often held up as an example of how licensing can be handled more efficiently (see Hishamunda et al, 2014 for example). Here a 'one stop shop' approach has been adopted and it can take as little as six months to arrive at a definitive response to licensing applications. Ireland is yet to adopt such an approach and the furthest the authorities have got in reforming the system is to commission a review of the system (Irish Government).

Beyond the licensing issue, the difficulty with multiple layers of regulation is again not a situation unique to Ireland. For example the EP (2009) note that 'It appears to be a fairly common perception amongst aquaculture stakeholders that conflict and overlap occurs in aquaculture, although the extent to which this occurs is likely to be less than is perceived. The Commission has recognized that there is generally a need for better coordination of policies and for some challenges to be dealt with at EU, national and local/stakeholder levels'. In theory 'One stop shops' can be extended beyond the issuing of licences such that they enable growers to interact with those that have an ongoing regulatory interest in the sector once the license is issued (Hishamunda, 2014).

The need for integrated approaches to managing the relationship between land and water in the bays where oysters are produced is clear due to the potential conflicts that can occur, including environmental issues. This integration needs to be across the regulatory authorities, but also there is a need to integrate all the stakeholders that have an interest in the sector (from producers through to local interest groups). Within Ireland, mechanisms exist have been developed that attempt this sort of integration. Co-ordinated Local Aquaculture Management Systems (CLAMS) have been established since 1997 (BIM, undated). Initially they arose to deal with managing salmon production in bays but have since expanded in their scope. The approach adopted for CLAMS is described in the Mission Statement as: 'The logical management approach is a locally based and all embracing system designed to maximise production and environmental management through the integration of production goals with minimal conflict with other resource users. Ireland is leading the way in the development of such a unique and progressive approach to bay/inshore waters management...This is a constantly evolving process in which a co-ordinated strategy is developed

and implemented for the allocation of environmental, socio-cultural and institutional resources to achieve conservation and sustainable multiple use of the coast.’ (BIM, undated)

On the surface, CLAMS is potentially the forum whereby mediation between different demands on the land and water can occur. However, it is telling that during the interviews with oyster producers when the challenges facing them were discussed and solutions considered, CLAMS was not mentioned as a possible mechanism. In addition, it may be reasoned that the level of antagonism to the perceived negative impacts of the environmental lobby on the oyster producers business makes balancing the competing aims much harder. To aid the process there is the need for clear Marine Spatial Planning strategies, so that the development of oyster farming (and other marine based sectors) can be placed in the context of the wider development (and protection) of marine resources (Qiu and Jones, 2013, Brennan et al)

There is a direct link between the resolving of the licensing challenges and measures to deal with many of the financial and biological risks facing oyster farming. For example, any move away from the almost total reliance on the French market requires significant investment, particularly in purification and marketing capacity. However, as noted in the results sector, the absence of licenses is seen as a major blockage to attracting outside funding either through traditional routes such as banks or less traditional ones such as venture capital. This in itself is an impediment to producers being able to make the necessary investment to move away from a dependence on the bulk export of oysters to the French market.

A further advantage of resolving the allocation of licenses is that there becomes the potential to make licenses tradeable as appears to be the case in Norway (Hishamunda, 2014). This creates a fungible asset with the potential benefit of attaining access to credit lines, whilst also having the potential to facilitate structural change in the sector (this is discussed more fully below).

Whilst addressing the regulatory failures within the sector has been shown to directly and indirectly reduce the risk profile of the sector, it can be seen as necessary but not sufficient to achieving a resilient aquaculture sector. This is in part because a significant number of risk factors will remain either in part or in whole. For example, the propensity for large losses to occur through disease or storms etc) which will directly impact on profitability as well as deterring outside investment in the sector.

Mechanisms and measures such as those highlighted in Table 2 are therefore needed to address these other risks. As just one example it may be argued that a fully functioning insurance market could make the industry more attractive to outside investment. Aquacultural insurance has attracted interest from international and other bodies (van Anrooy et al, 2006; Stimpson and Co, 2007) Whilst private insurance schemes do exist, the challenges facing insurance in this area are similar in nature to those facing agriculture but these are exacerbated by the fact that in many cases production occurs in the sea. As noted by the Irish Government ‘Aquaculture insurance is one of the tools used in aquaculture risk management, but there is considerable ignorance within the aquaculture industry about its availability, the process of obtaining insurance cover, especially on aquaculture stock mortality, and the constraints to insurers providing its services (ref Irish Government).’ Some recognition of the difficulty has emerged in Ireland and the latest Marine Development Plan includes provision for forms of public insurance for such factors as algal blooms and loss of seed through viruses. However, perhaps inevitably due to funding and other constraints, the approaches seem limited (for example business can only make one claim during the duration of the plan for losses due to algal blooms etc). If effective insurance policies can be developed these

may offset some of the natural fear from outside investors in terms of the risks involved with investing in the oyster industry.

Structural Change?

The previous discussion highlights that for many of the risks there are, with the will and sufficient resources, options available to either prevent, mitigate or help the industry cope with the risks. However, there are broader questions at the sector level as to how best to ensure the long run viability of the industry. In the next section a more holistic view of the further development of the sector is considered in particular the structures needed. Possible options include forms of co-operation and collaboration or supporting the development of individual businesses.

Discussion with those involved in the industry (outside of production), highlights a consensus that there are significant opportunities for greater collaboration and cooperation to overcome some of the challenges that the sector faces. The concept of the value-net (or co-opetition) has been discussed more generally in an Irish context (see Bord Bia, 2012 for example).³ However, it appears nowhere more applicable than in the Irish Oyster industry where there is a relatively new industry facing scale and fragmentation challenges that could benefit greatly from increased cooperation between members.

As noted above, many of the costs associated that may decrease the sector's vulnerability to the key risks are fixed in nature (for example purification plants, marketing, quality assurance etc.) and, in principle, through cooperation and collaborative efforts these costs could be spread over greater levels of production, reducing the cost to each individual business improving not only their profitability, but also the competitiveness of the sector as a whole.

Of course, cooperatives already exist within the sector, for example traditional oyster production is characterised by cooperative action. There are also examples of previous cooperative efforts in oyster farming, although their performance was seen as quite mixed by those interviewees who had been involved. From our interviews we also found many examples of more informal collaboration amongst producers.

Recent EU legislation facilitates the establishment of producer organisations in the aquaculture sector. The industry experts interviewed saw a range of potential roles for such structures in the Oyster industry which can contribute to either financial (FS) or biological (BS) security including:

- 1) Price co-ordination (FS)
- 2) Shared marketing (not necessarily a common brand for all Irish production) (FS)
- 3) Quality Assurance including ensuring Food Safety through purification etc (BS)
- 4) Procurement (FS)

In addition the relatively low levels of technology currently involved in Oyster production suggest that gains can be achieved from the collective funding of research to improve innovation within the sector.

Potentially all the above benefits could be significant for the sector, however, discussion with producers highlighted a number of possible challenges to the successful formation of producer organisations. Whilst collaboration is occurring between some of the largest producers (for example

³ The basic idea of co-opetition is that firms collaborate in areas that enable the industry as a whole to grow, thus benefiting all those in the industry whilst still competing in other areas.

through supporting marketing initiatives in Asia), it is clear that some tensions do exist and they are wary of more formal collaboration. Some of their concerns arise from factors such as: the different levels of market orientation (including the development of individual brands); poor experiences with cooperative action in the past and; concern that other producers may have lower quality standards (particularly when considering shared purification facilities). Whilst these issues are not insurmountable, it is clear that the perceived concerns need to be overcome for Producer Organisations to work successfully in this sector.

As noted earlier, around 15 businesses are estimated to account for 70 per cent of production in Ireland. In a number of other food sectors we have witnessed increasing levels of concentration (salmon, poultry, pigs etc) often involving the development of sophisticated contract farming relationships. It is possible to envisage a similar model for the Irish oyster sector where a few large businesses emerge that deal with and contract smaller producers to grow the seed (up to various stages of development depending on need). These larger farms could potentially have the resources (and more importantly access to finance) to invest in the necessary quality assurance processes, purification plants and develop marketing as well.

There may be a role for the public sector to facilitate this structural change through grants for investment or through use of the licensing system. The latter could be explicit through directing the allocation process, but also it could occur implicitly through making licenses tradeable. A tradeable license system has the benefits that it could allow an exit strategy for the smaller producers and an alternative to contract farming.

The difficulty for the indigenous producers is that there is no guarantee that they would be able to purchase the licenses if they were made tradeable. More established French firms with sufficient capital behind them may be in a better position to purchase the licenses. This leads to the thornier question whether or not the businesses that grow in this process are Irish in origin or foreign (most likely French) owned.

More generally a strategy of supporting particular businesses over others has a number of pitfalls. There are the usual problems of identifying who the 'winners' are and not disadvantaging emerging businesses who have the potential to grow themselves. In the interviews there was a perception amongst smaller producers that this was already the case that this was already the case with larger producers being favoured at their expense.

As individual producers get bigger and stronger, it may be reasoned that it makes co-operative strategies such as the formation of producer organisations less viable as the key players are likely to need them less. It may be argued that because of this, a mixed approach that tries to support the largest producers whilst pushing for producer cooperatives may not be entirely consistent and therefore likely to fail.

Conclusions

This paper has examined the development of the Irish Oyster industry as an example of the challenges facing the development of the aquaculture sector more generally in many regions of the world. It highlights the vulnerability of the Irish Oyster industry to a range of risks but identifies regulatory failure, particularly in the form of a dysfunctional licensing system, as one of the greatest risks to the orderly development of the industry. It also highlights clearly how regulatory risk interacts at a number of levels with other risks faced by producers leading to greater levels of these risks. It was argued therefore that resolving the licensing issue and improving regulation more broadly can potentially allow the industry to grow in Ireland. However, it is also clear that other

constraints need to be addressed (that is many risks will remain). At one level there are approaches and measures that can be taken that address the identified risks individually, many of these have been applied successfully in other situations and could be successful within an Irish context (Hishamunda, 2014; OECD, 2009, FAO code for responsible fisheries). At another level, a more holistic view of the industry needs to be taken which relates to its overall governance. It is clear that due to the vulnerability of the sector a clear strategy needs to be developed and followed through to support the structural changes necessary to ensure that the sector not only survives but has the possibility to thrive and take advantage of the opportunities that exist.

On one level, clear principles have been established as to the characteristics of good governance. Hishamunda et al (2014, p1) note 'The challenge of aquacultural governance is to ensure that the right measures are implemented to ensure environmental sustainability without destroying entrepreneurial initiatives and social harmony.' They proceed to argue that 'over-regulation destroys entrepreneurial initiative and motivation – the very ingredients necessary for successful commercial aquaculture' (p20). However, it is clear that putting good governance into practice is not straightforward.

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