Innes, J., R. Martini and A. Leroy (2017-09-22), "Red tape and administrative burden in aquaculture licensing", *OECD Food, Agriculture and Fisheries Papers*, No. 107, OECD Publishing, Paris.
<http://dx.doi.org/10.1787/7a56bfbc-en>

OECD Food, Agriculture and Fisheries
Papers No. 107

Red tape and administrative burden in aquaculture licensing

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OECD FOOD, AGRICULTURE AND FISHERIES PAPERS

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RED TAPE AND ADMINISTRATIVE BURDEN IN AQUACULTURE LICENSING

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Concern that rates of aquaculture growth in OECD countries are below potential has resulted in environmentally sustainable production increase becoming a priority for policy makers. Growth in aquaculture production can be influenced by many factors. This report looks at the attributes of licensing and regulatory systems in OECD countries, the area over which policy makers have greatest direct control, and finds some suggestion they may be negatively related to aquaculture growth rates. Opportunities exist for reducing the administrative burden faced by enterprises, without sacrificing regulatory quality in the process. There is also a strong indication that quality governance, aided by having systems of evaluation and review in place, helps reduce overall administrative burden. Comparing the attributes of licensing systems with environmental performance was not possible due to the lack of suitable indicators. This highlights the need to measure environmental performance if regulatory effectiveness is to be evaluated further.

Keywords: licensing; aquaculture; bureaucracy; environmental policy; regulatory policy; indicators; licences; seafood farming

JEL classification: Q01, Q22, Q28, O470

Acknowledgements

This paper was prepared by James Innes, Roger Martini and Antonia Leroy of the OECD Trade and Agriculture Directorate (TAD). The authors are grateful for the input of all the countries that participated in the survey, Franck Jésus the TAD/NRP Fisheries team and the OECD Fisheries Committee (COFI) for helpful comments on earlier versions of the document, Stefania Vannuccini of the FAO for help with aquaculture production data and Fabiana Cerasa of TAD/NRP for statistical support. The indispensable help of Stéphanie Lincourt and Natasha Cline-Thomas in co-ordinating the editing and publication process is gratefully acknowledged.

This report was declassified by the OECD Fisheries Committee on 17 October 2016.

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Executive summary

Aquaculture is an important source of food and jobs, but development of the sector in OECD countries has lagged behind that in other countries, particularly when considered in the context of the People's Republic of China (hereafter “China”), Indonesia and India which are the top 3 producers globally. This has led to concerns that aquaculture growth in OECD countries is below its potential and policy makers have made production growth within the limits of environmental sustainability a sector priority.

There are many factors that influence the growth rate of aquaculture, including environmental carrying capacity, conflicting demands by multiple users of marine spaces, and costs imposed by the formalities of licensing and regulation. Of these, policy makers have the most direct control over the licensing and regulatory system, making this an important area for study. This report investigates the potential for improvement and finds that aquaculture licensing and regulation can slightly affect growth rates in OECD countries, and there are opportunities and benefits to reducing the administrative burden faced by enterprises.

Good regulation is essential to the healthy growth of the sector, to protecting the environment and sharing public spaces and resources. However, poorly designed regulation can retard growth by limiting competition, stifling innovation, and preventing new enterprises from emerging. A lack of information and indicators on environmental performance meant this work was unable to assess the importance of environmental concerns in relation to the design of licensing systems, despite this, the evidence presented here suggests that environmental stringency and effective regulation need not imply a high level of administrative burden for enterprises.

This study uses survey data on aquaculture licensing systems from OECD members and some non-member countries to investigate the design of licensing schemes. It builds on existing OECD work on Product Market Regulation (PMR) indicators and the Burden on the Economy of Environmental Policies (BEEP), which provide a ready framework for analysis of the burden of licensing and permit systems for aquaculture. The results highlight the need for better measurement of environmental outcomes of aquaculture operations to support regulatory evaluation and review.

Key findings

- Experts from governments agree that aquaculture licensing systems are generally achieving their goals for environmental and social protection, even though in the majority of cases these systems are not currently as simple as they could be.
- The extent of administrative burden is highly variable, with no corresponding evidence that effectiveness is equally variable. This suggests that there is opportunity to reduce levels of administrative burden on aquaculture producers without sacrificing regulatory quality in the process.
- Administrative burden has some negative correlation to growth; licensing systems displaying high levels of administrative burden tend to have lower rates of growth. Higher levels of burden also imply higher costs for enterprises.

- Quality governance, as measured by institutional oversight, consultation and planning, helps to reduce administrative burden. Additionally, having formal processes to evaluate the effectiveness of regulation and review its impacts support good governance. The results show limited use of evaluation and review, suggesting an opportunity for beneficial reforms by increasing their use in order to help reduce administrative burden over time.
- The observed significant negative correlations between the level of administrative burden to entry and both governance quality and evaluation and review are consistent with experiences in other sectors and provides empirical support to the use of these practices as a standard feature of policy design.
- It was not possible to compare the attributes of licensing systems with environmental performance due to a lack of suitable indicators. This highlights the need to measure environmental performance if regulatory effectiveness is to be evaluated further.

OECD countries falling behind global growth in aquaculture

Figure 1. Rapid global aquaculture growth over 20 years, but much slower in OECD countries

Source: FAO FishStat

Although global aquaculture is growing rapidly, this growth is unevenly distributed among countries, with most of it occurring in a limited number of countries. China, Indonesia and India are the top 3 producers in the world and in 2014 accounted for 77% of total world aquaculture production by volume (tonnes) (FAO, 2016b). OECD countries account for only 7.5% of world aquaculture production by volume (tonnes) but 20.4% in terms of value compared to 31% and 40% respectively in 1985. OECD countries tend to produce relatively higher value species. The Republic of Korea, Japan, Norway and Chile were the main OECD producing countries in 2014 (Figure 2) (FAO, 2016b).

In many OECD countries growth in aquaculture production has been relatively low over the last two decades, with an annual average growth rate of 3% in volume and 8% in value between 2005 and 2014. Policy makers have made increasing production growth within the limits of environmental sustainability a sector priority (European Commission, 2013; Turkey Department of Aquaculture, 2016; Sweden, 2016; Australia Queensland Aquaculture, 2016) and identifying existing constraints to growth is a central component of these strategies.

Figure 2. Disparity in aquaculture growth*Top 5 OECD aquaculture producers by value (including aquatic plants)*

Source: FAO FishStat

Could licensing requirements explain slower growth in OECD countries?

There are a number of reasons for which growth in the OECD region lags behind other countries. The main factors may be resource availability and environmental limits such as availability of space for production, limits on feed supply and environmental carrying capacity of waste products (FAO, 2014; OECD, 2010). These fundamental environmental limits to growth and the conflicting demands for shared marine spaces by multiple users are unlikely to change, making regulatory improvement a promising route for policy makers to support sustainable growth in the aquaculture sector. To evaluate this potential, the effect of administrative burden on growth needs to be measured.

The impacts of regulatory burden on aquaculture can be significant when they unnecessarily limit innovation, trade, investment and economic efficiency in general (OECD, 2009a; European Commission, 2013). For instance, strict licensing procedures may increase barriers to entry and competition, market concentration, risk of anti-competitive behaviour and slow growth (Koźluk, 2014). Red-tape affects entry costs and can slow down the process of starting and operating a business through, for instance, additional bureaucratic requirements related to licensing or the need for additional investments in monitoring and reporting.

One explanation for the significant growth variation in the aquaculture industry across countries may be related to the process and requirements for getting access to licences and how different countries handle and enforce the rules and regulations attached to the licences. Licences, the right or permit to conduct business is granted by authorities as an authorisation to start and operate an enterprise, as well as to use natural resources or spaces and regulate different environmental externalities such as pollution associated with aquaculture production.

The literature on regulatory policy and governance in general seems to confirm that poorly designed regulations can stifle economic activities and ultimately reduce economic growth (Parker & Kirkpatrick, 2012). Regulations that discriminate between existing firms and new entrants, for example, by imposing more stringent environmental performance requirements on new-entrants, may also provide direct cost-advantages to incumbents by increasing the costs associated with “learning” how to comply with complex regulations (OECD, 2006a; Heyes, 2009). While some of the above may constitute a necessary cost of regulating the aquaculture sector within the limits of environmental sustainability, the size of this cost and the effect on entry and growth will depend on the details of the design and implementation of licensing systems.

Box 1. Definition of administrative burden

*The term **administrative burden** refers to the cost to business of carrying out administrative activities necessary in order to comply with governmental requirements, which includes: “regulatory costs in the form of asking for permits, filling out forms, and reporting and notification requirements for the government.” (OECD, 2008; 2009a). The phrase administrative burden is often used interchangeably with other terms including; red tape, compliance burden or compliance costs. Whilst all these terms refer to the costs associated with complying with government requirements a distinction can be made between what are, on the one hand, unnecessary, purely administrative burdens imposed by poorly designed systems (red tape), and on the other hand, the costs of complying with appropriate requirements of licensing and regulatory systems (e.g. well-designed environmental requirements). The first should be avoided where possible, while the second are a legitimate and necessary part of regulation.*

Quantifying the attributes of aquaculture licensing systems in OECD countries

Identifying factors that determine and reduce the efficiency of aquaculture licensing helps target regulatory actions to improve licensing frameworks. The objective of this work is to investigate the design of licensing schemes, which may be one of the potential constraints to aquaculture development. This work is intended to help us better understand the design of these schemes in OECD countries and their impact on productivity.

This report uses the findings of a survey of aquaculture licensing systems in OECD countries to identify the systems in place and investigate whether certain approaches are beneficial to growth. It does this by using the survey results to construct four indicators that represent key elements of licensing systems in a number of OECD Members (also Indonesia and Peru)¹. These indicators summarise the results of the survey and are used to relate different characteristics of the licensing system with outcomes in aquaculture growth as follows:

- **Administrative burden associated with licensing procedures** – this indicator groups questions capturing the administrative complexity related to licensing faced by the entrepreneur when opening a company.² Questions include combined or simplified approval processes, legal time limits on the administrative response to a request for a licence and ease of access to all necessary information.
- **Market characteristics** – this indicator captures the property-right and other market-related characteristics of licence systems. Following Nielsen et al. (2015) it examines the transferability,

¹ This data has been used for analysis of patterns across countries. It is not designed to report on the situation in individual countries and should be interpreted with caution in that regard.

² The idea resembles that of licence and permit systems and administrative burdens in the barriers to entrepreneurship indicators in the Product Market Regulation Indicator structure – which focuses on regulations increasing the cost of entry.

divisibility, duration, and quality of title of licences and other factors that could impact on the economic efficiency of the sector.

- **Evaluation and review** – this indicator attempts to capture the frequency, breadth and depth of licensing systems reviews in terms of administrative and economic cost, efficiency and simplicity, and ability to meet objectives.
- **Governance characteristics** – this indicator measures the degree of planning and strategic focus behind aquaculture policy through, for instance, aquaculture strategies, development plans and clear objectives. It also captures procedural matters like the transparency of information available and the rights of applicants.

The approach taken in this assessment broadly follows the framework established by previous OECD work that has derived indicators for both product market regulation (PMR) and burden on the economy of environmental policies (BEEP) (Koske et al., 2015 and see www.oecd.org/eco/pmr). The BEEP indicator, in particular, focuses on the impact of regulation on growth and economic activity and serves as a valuable example of how to compile and present this kind of information (Kozłuk, 2014).

First, data on aquaculture licensing systems was collected by surveying individual countries (This survey is reproduced in Annex 1). Where licensing systems differed regionally or with the form of production the reporting country was given the opportunity to provide multiple responses. This resulted in some countries having more than one observation in the final dataset and where this occurs, data points are labelled according to the country, region and form of production.³ The categories relating to the form of production were limited to: marine fish (MF), freshwater fish (FF), shellfish (SF), aquatic plants (AP) or all aquaculture (ALL), following feedback received on the pilot questionnaire.

A total of 27 countries participated in the aquaculture licensing survey yielding 57 usable responses.⁴ Three countries reported differences in their licensing systems at the regional level and 18 countries or regions reported that at least one form of aquaculture production (marine fish, freshwater fish, shellfish, aquatic plants) was subject to a licensing system that differed to their general (all aquaculture) system (please see Figure A2.2 in Annex 2 for a detailed breakdown).

The BEEP indicator is constructed using a process of scoring and aggregation to build sub-indicators that are then combined to produce a single main indicator (Kozłuk, 2014). This work follows a similar approach, but uses only the four sub-indicators for its analysis. Questionnaire responses are sorted based on their relevance to the question of interest (such as burden of licensing schemes and market characteristics). Each question is then assigned a score between 0 and 1, where 0 is the lowest administrative burden, or least associated with market characteristics, policy review etc. The scores of follow-up or subsidiary questions are merged with primary questions so they do not overweight the indicator.

³ For example, the label AUS.WA.MF relates to the country Australia (AUS), the region of Western Australia (WA), and the production form marine Fish (MF). Where licensing conditions did not vary at the regional level, again using the above example, it would read as follows: AUS..MF.

⁴ In a number of cases, where additional questionnaires were submitted for specific forms of production, the responses to questions were identical to those for the country's general aquaculture policy (i.e. "all aquaculture"). This does not mean that licensing conditions for the reported forms of production do not differ from the country's general policy in these cases as it is possible that the inability to distinguish between them in this context is a consequence of the questionnaire not containing the questions necessary to identify the differences. However, as these were ultimately duplicate responses they were omitted from all correlation analysis to avoid weighting the results (e.g. when country X has given the same answers for "all aquaculture" production and "marine fish" production, resulting in the two having identical scores across the indices).

Scores for the different questions are then aggregated into four individual low-level indicators (administrative burden to entry, market characteristics, evaluation and review, governance characteristics), with equal weights and rescaled to a 0-6 scale. A higher score means more administrative burden or a greater presence of the other measured characteristics (please see Annex 1 for detail on scores and aggregation). Potential limitations of the approach applied here are discussed in more detail in Annex 4.

In all cases the indicator values tend towards 6 as a licensing situation demonstrates more of the attributes associated with the issue under consideration. For example, a score of 5 for administrative burden to entry implies that there is a greater level of burden than in a case where the score is 2. Likewise, a score of 5 for market characteristics indicates more market based characteristics are reported to exist in the licensing system in question than in the case of a score of 2. Whether a higher score is interpreted as being either positive or negative (from the perspective of growth in the industry) depends on the attribute under consideration. The resulting index numbers are essentially unitless such that relative differences are more informative than their absolute size.

Aquaculture licensing systems are perceived to be achieving their objectives, but could be simpler

Results from two general overview questions suggests that whilst in the majority of cases licensing procedures are believed to be achieving their goals (61%) there is also the belief that in the majority of cases administrative procedures are not as simple as they could be (67%). These results (Figure 3) come from government responses to two questions:

- “In your view, are the administrative procedures in your country effective at achieving the government's goals for them?”, and
- “In your opinion, are the administrative procedures in your country as simple as they can be for aquaculture enterprises?”.

Figure 3. Aquaculture licensing systems are perceived to be achieving their objectives, but could be simpler

These questions do not directly feed into the indicators, but provide background information against which to consider the results.

Governance characteristics and administrative burden are where licensing systems differ the most

The four aquaculture licensing indicators all display some degree of variability (Figure 4, also see Annex 2 for disaggregated plots). The range of results by country suggests that a wide variety of approaches are taken for the governance of aquaculture, and the associated burden also varies considerably. The high level of dispersion observed for administrative burden implies that in many countries there is scope for improvements that reduce the burden faced by aquaculture enterprises.

The range of results in the indicators also shows a similar but low rate of use of market characteristics and evaluation and review. The average and variance of these indicators are below that of burden to entry or general governance features.

Figure 4. Licensing systems differ largely on administrative burden and governance, much less on market characteristics and evaluation and review

Note: please see Annex 2 for an explanation on how to interpret boxplots

Administrative burden appears greater when evaluation and review and governance characteristics are low

Pairwise comparisons of indicators and the related correlation coefficients provide some insight into how they interact and whether there could be relationships between them, keeping in mind that correlation does not always imply causality (Figure 5 and Table 1). The statistically significant correlations between the aquaculture licensing indicators tend to follow *a priori* expectations:

- The indicators assessing governance characteristics and evaluation and review are positively correlated.
- The indicator relating to administrative burden to entry is negatively correlated with those for governance characteristics and evaluation and review.

The positive correlation between governance characteristics and evaluation and review supports the idea that systematic evaluation and review can improve governance arrangements (OECD, 2009b).

Situations where governance is of high quality are likely to be accompanied by the existence of conditions requiring and enabling the evaluation and review of licensing systems. For example, in this assessment governance conditions that are based on well-defined strategic plans and that set out clear criteria and measurable targets also often have processes to regularly assess burden, the economic impacts of licensing arrangements, and seek input from stakeholders.

Administrative burden to entry is negatively correlated with both evaluation and review and governance characteristics. This implies that limited evaluation and review or weak governance may allow burdensome licensing conditions to become established. This provides some evidence to support the view that these institutional characteristics are a best practice for governments.

For example, approaches such as the 90-day regulatory mapping project recently initiated by the government of Western Australia can contribute to the process of reducing regulatory burden. This project actively engages with industry groups and stakeholders to improve regulatory outcomes by assisting planning and helping identify opportunities to reduce regulatory burden in areas such as application processes, licensing arrangements and reporting requirements.⁵

The aquaculture indicators were also compared with a selection of national level indicators relating to factors such as regulatory burden and policy stringency to test whether they offer an improved understanding over what is available in existing national equivalents. This suggests that the aquaculture indices do provide new information and a greater understanding of conditions specific to the aquaculture industry and is reported on in Annex 3.

Table 1. Administrative burden to entry is greater when either evaluation and review or governance characteristics are lower

	<i>Administrative burden to entry</i>	<i>Evaluation and review</i>	<i>Governance characteristics</i>
<i>Evaluation and review</i>	-0.349** [-]	-	-
<i>Governance characteristics</i>	-0.351** [-]	0.333* [+]	-
<i>Market characteristics</i>	-0.085 [-/+]	0.245 [-/+]	0.148 [-/+]

Note: Measures of correlation (Spearman) between the aquaculture indicators (significance asterisks (*0.05, **0.01, ***0.001, [] indicates a priori expectations of sign), n=57.

⁵

http://www.finance.wa.gov.au/cms/Economic_Reform/90_Day_Projects/Aquaculture_Business_01.aspx

Figure 5. Individual aquaculture licensing indices plotted against each other

Ad-hoc processes of evaluation and review are more prevalent than regular formalised ones, but it is more common to not have any process at all

When responses to individual questions from the questionnaire are considered it appears that formalised processes to regularly review licensing systems are limited. When asked if there was a process to review the economic impact of aquaculture licences (QC1) only 5% of the responses indicated that a regular programme was in place, 20% indicated that there was no regular programme but that ad-hoc reviews had taken place in the past, and the remaining 75% said that there was no review process (Figure 6).

Figure 6. Most systems do not review the economic impact of licensing arrangements

Similarly, when asked if a specific process existed to collect information on the current administrative burden of aquaculture licensing (QC2) the responses were comparable. Only 5% indicated that there was a regular programme, 29% reported that only ad-hoc reviews had taken place, whilst the majority (65%) indicated that there was no process in place to collect information on administrative burden (Figure 7). When asked if there was a process to review potential improvements to the administrative burden of aquaculture licensing (QC3) the responses were more positive, with 24% of responses indicating that there was.

Figure 7. Most licensing systems do not collect information on administrative burden

On the topic of including stakeholders in the process of reviewing licensing systems (QC4) responses suggest that 62% of the systems surveyed either do or have at some point sought input from stakeholders in some way (Figure 8). However, only 6% of licensing systems were reported to have a formal process that actually encouraged businesses and stakeholders to flag burdensome regulations or propose simplifications, whilst 46% did so on an ad-hoc basis and the remaining 38% did not have a system in place to collect feedback.

Figure 8. Processes to include stakeholders in reviews of licensing systems are primarily ad-hoc

The responses to these questions reinforce the observation that in general there appears to be scope for greater development of the evaluation and review components of the licensing systems surveyed.

Multiple administrative processes and an absence of time limits increase burden

Additional factors of importance are the number of entities that new businesses must contact in order to obtain the licences they require to begin operating and the time it takes for these to be granted. Lengthy application processes and processing times can add to the cost of establishing a business and slow growth in the industry. The results indicate that in 46% of licensing systems businesses only need to contact a single entity when establishing an aquaculture business (QA2), with the average being just over two entities and a maximum of six (QA2.1). The average time required to gain approval to operate (QA10) was seen to vary considerably though, ranging from 30 to 730 days, with a mean of 235 (Figure 9).

Figure 9. Average approval times for licences and legal time limits

(number of observations in blue)

Only 40% of the licensing systems report using legally defined limits on processing times to speed up the approval process (QA6) (Figure 9). Furthermore, if multiple licences are required and they cannot all be applied for in parallel then the total time required to obtain permission to operate can be drawn out as a consequence. This appears to be the case here, as the average approval times tend to be higher than the legal processing times (mean legal processing time 116 days) and only 25% of the licensing systems reportedly have a single integrated aquaculture licence (QA4). In the remaining 75% of cases operators are

reported to require an average of five licences in order to operate (QA4.1). Figure 9 shows that the average approval time is often close to the upper limit of the legal processing time, meaning that these limits are effective at reducing processing times when they are used.

These findings reflect issues raised in the Multiannual National Strategic Plans for the development of aquaculture produced by EU member states, which identify application processing time and uncertainties as being amongst the main challenges facing their aquaculture sectors.⁶ Actions to review and streamline procedures by using one-stop-shops, online applications, and lengthening the duration of licences were the most cited actions planned to overcome these issues. Other planned actions include increasing support in the application process and strengthening public administration through greater co-ordination and capacity building.

Few licensing systems are reported to require that new businesses conform to licensing requirements or thresholds that differ to those applied to established businesses (only 27%), so called vintage differentiation. This can inhibit the entry of new firms, potentially constraining growth in the process (OECD 2006a; Heyes 2009).

For further discussion on responses to individual survey questions please see Annex 2.

Growth in the value of aquaculture production is negatively correlated with administrative burden to entry

The final aim of this work was to assess whether aquaculture licensing systems impede aquaculture growth in OECD countries and whether less burdensome licensing systems can be designed without increasing the potential environmental impact of the activity. On the latter, attempts were made to include industry-specific indicators of environmental performance in this process, but a suitable metric could not be found. During the first phase of the Streamlining European Biodiversity Indicators project (SEBI)⁷ the European Environment Agency (EEA) began developing an indicator to report on aquaculture effluent water quality (SEBI 22). The intention was to estimate actual nitrogen and phosphorus discharge at the national level by modelling nutrient production with the use of appropriate conversion factors.⁸ However, so far the indicator has not been produced and it appears that there are currently no plans for its development. No other potential indicators of environmental performance could be identified and analysed.

Whilst it is essential that licensing requirements ensure aquaculture businesses meet their environmental obligations it is also important that in doing so undue burdens are not placed upon these businesses as this has the potential to unnecessarily limit growth. The inability to compare aquaculture licensing indicators with aquaculture specific measures of environmental performance is unfortunate as it would assist us more clearly identify what any relationship between burden and good environmental performance looks like, and whether the latter can be jointly achieved with low administrative burden.

For the former goal (the link between aquaculture growth and licensing systems), the aquaculture licensing indices were considered alongside data on aquaculture production for the countries that responded (Table 2, Figure 10). This allowed us to investigate whether there is any indication that observed rates of growth in the aquaculture industry might be related to attributes of the licensing systems assessed. Correlations expected between growth in aquaculture production and the licensing indices would likely be as follows:

⁶ http://ec.europa.eu/fisheries/cfp/aquaculture/doc/27-multiannual-national-aquaculture-plans-summary_en.pdf

⁷ <http://www.eea.europa.eu/publications/streamlining-european-biodiversity-indicators-2020>

⁸ <http://www.eea.europa.eu/data-and-maps/indicators/aquaculture-effluent-water-quality-from-aquaculture-effluent-water-quality-from>

- Higher administrative burden to entry could be associated with lower growth, following the assumption that burden to entry potentially impede new entrants and competition. It is likely that some level of burden is inevitable and necessary for effective administration of the industry, particularly where negative externalities may arise in its absence. But administrative burden may increase beyond a point where it starts limiting growth.
- Greater levels of evaluation and review and governance characteristics could be associated with higher rates of growth, following the assumption that increasing the level of either is believed to help limit the adverse effects of excessively restrictive regulations and licensing requirements. Recognition of this is a motivating factor behind recommendations to implement practices such as regulatory impact analysis (RIA) (OECD, 2009b), as stipulated in the Recommendation of the Council of the OECD on Regulatory Policy and Governance (OECD, 2012).

The impact of market characteristics is less clear. Market-based tools are meant to increase flexibility, reduce compliance costs, and aid investment. Cap-and-trade systems such as the EU Emissions Trading Schemes (ETS) are an example of such tools. However, market instruments such as ITQs in the context of fisheries have also been observed to increase costs and administrative burden in some applications.

Table 2. Negative correlation between the aquaculture growth rate and administrative burden to entry

	<i>Administrative burden to entry</i>	<i>Evaluation and review</i>	<i>Governance characteristics</i>	<i>Market characteristics</i>
<i>Average percent rate (APR) of growth (tonnes)</i>	-0.243	0.244	0.179	-0.248
<i>APR(domestic currency '000)</i>	-0.137	0.038	0.151	-0.081
<i>APR(US\$ '000)</i>	-0.305*	0.036	0.201	0.027

*Note: Measures of correlation (Spearman) between aquaculture indices and alternative measures of growth in aquaculture production 2005-2014 (significance asterisks (*0.05, **0.01, ***0.001), n=46.*

If aspects of licensing systems can be correlated with growth it will help governments improve growth rates, particularly if specific influential factors within indicators can be more clearly identified. Conversely an absence of correlations suggests that the licensing conditions assessed are unlikely to have a major effect on growth rates in the industry and that other factors are likely to be more determinant in limiting growth.

Disaggregated data on aquaculture production, both volume and value, for the period 2005-2014 were obtained from the FAO⁹ and used to calculate growth in production at the national level. The average percentage rate (APR), as utilised by the FAO when quantifying annual rates of growth, was used (see Annex 4 for details).

⁹

Using FishStatJ (<http://www.fao.org/fishery/statistics/software/fishstatj/en>) and the global workspace: Aquaculture Production (Quantities and values) 1950-2014 (Release date: March 2016)

Figure 10. Negative correlation between growth in aquaculture production (APR USD) and administrative burden to entry

When the level (i.e. national, regional) and form of production (i.e. all aquaculture, marine fish, freshwater fish, shellfish, aquatic plants) varied for some responses, the data relating to aquaculture production was, where possible, aggregated to match. Where differences in the form of production occurred at the national level FAO data was used, and aggregated up into the appropriate groups, but in cases where the indices also reflected differences in licensing at the regional level data was sourced directly from the country.¹⁰ This ensured that aquaculture production data were matched as well as possible to the indices (i.e. country, region, form) and that the growth indicators derived from the data were comparable.

Despite these efforts to match production data with the reported licensing systems, production data was not always available at the same level. For example, instances where licensing conditions for aquatic plants were reported on in the survey but figures on production do not or only exist for a small number of years due to production having recently started. In such cases, or where production data was missing for other reasons, the associated indices could not be included. This reduced the number of observations to 46.

Administrative burden to entry appear to be significantly correlated only to growth assessed in USD (Table 2, Figure 10). No other coefficients were statistically different to zero, however the signs were generally as expected. This provides only very weak evidence of a relationship between administrative burden and growth rates in aquaculture (please see Annex 4 for additional plots comparing administrative burden with growth in domestic currency and quantity). Whilst weak, this result is consistent with the initial assumptions and with the broadly recognised influence of administrative burden as a constraint on growth in the economy (OECD, 2009; Koźluk, 2014). It also supports suggestions that the impacts of regulatory burden on aquaculture can be significant when they have impacts such as unnecessarily slowing the process of establishing operations (European Commission, 2013).

¹⁰

This was the case for Australia (<http://www.agriculture.gov.au/abares>), Canada (<http://www.dfo-mpo.gc.ca/stats/aqua/aqua-prod-eng.htm>) and Germany.

The absence of any clear patterns between the remaining licensing indicators and those for growth rates in aquaculture production suggests that these are unlikely to have had major direct effects on growth in the industry over the period considered. However, the observed correlation between administrative burden to entry and evaluation and review and governance characteristics suggests that the impact of the latter two on growth could be more indirect in nature, via the influence they potentially have on administrative burden to entry in the industry. As such, it is possible that these aspects of the licensing systems still play a role in facilitating growth but by reducing burden to entry.

Whilst the explicit focus of this work was to consider how licensing systems influence growth in the aquaculture sector it is worth reiterating the fact that a range of additional factors also influence the ability of countries to further increase output, factors that include: environmental limits such as space for production (e.g. length of coastline), limits on feed supply and environmental carrying capacity of waste products. These all have the potential to reduce or constrain growth and should be considered alongside licensing conditions for a comprehensive understanding what is of greatest importance to growth in a specific situation.

Can and should administrative burden be reduced?

The survey responses show that government experts agree that aquaculture licensing systems generally achieve their goals, even though in the majority of cases these systems could be simplified. Some systems in OECD countries provide the desired amount of social and environmental protection with relatively low burden, while others do so at a higher cost to aquaculture enterprises. While this additional burden does not appear to stifle growth, it may not provide benefits commensurate with its cost.

The range of scores observed in relation to administrative burden to entry is relatively large, suggesting that in many countries it may be feasible to achieve lower levels of burden than currently observed without sacrificing public objectives. Scores for both evaluation and review and market characteristics are generally low which indicates an opportunity for beneficial reforms that can help reduce administrative burden over time.

The correlation analysis used in this report was based on four aggregate indicators of administrative quality. These indicators were built by scoring and aggregating a set of related survey questions. A more detailed analysis of the indicator for evaluation and review might help identify whether specific factors have a stronger influence on this correlation and could be tested for their influence on administrative burden.

The results also show that licensing systems displaying high quality governance typically also display relatively high levels of evaluation and review. They also show that administrative burden to entry is generally lower in licensing systems where either governance quality or evaluation and review are high. The observation that there is a significant negative correlation between the level of administrative burden to entry and governance quality, evaluation and review is consistent with experiences in other sectors and provides empirical support to the use of these practices as a standard feature of policy design.

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Annex 1

Survey questions and information on calculations

Table A1.1. Administrative formalities associated with licensing procedures

Scoring of answers		
(A1) How can an entrepreneur about to set up a company find out what licences, permits and procedures are required?	There is a website containing detailed information on requirements for new and existing enterprises.	0
	The entrepreneur will be informed during the company registration process about need for permits (general or activity specific).	0.5
	The entrepreneur is responsible for finding this information on her or his own.	1
(A2) Is there a single contact point where the entrepreneur can obtain all necessary permits and licences or submit all necessary notifications?	There is such a single contact point and it is the same contact point as for other necessary registration or start-up procedures (full one stop shop)	0
	There is such a single contact point, but it is not the same contact point as for other registration or start-up procedures common to all businesses (aquaculture one stop shop)	0.5
	There is no single contact point for aquaculture permits and licences and firms must contact more than one entity	1
(A2.1) If there is no single contact point please indicate the number of entities entrepreneurs must contact:		-
(A3) Can the application or notification regarding aquaculture licences and permits be done with a single application form?	Yes, it can be submitted via a single application either online or manually	0
	Yes, it can be submitted via a single application but this must be done manually	0.5
	No, it must be done with different forms (e.g. regarding different licences or different institutions, such as national and local), but all can be arranged online	0.5
	No, it must be submitted manually with multiple forms	1
(A4) Is there a single integrated aquaculture permit or licence?	Yes	0
	No	1
(A4.1) IF you answered NO to A.4, for these types of aquaculture, please identify the specific permits or licences required in each case:	Resource assessment	1/10 for each No
	Lease of public land or water	
	Development and operating approvals	
	Specific operating conditions and controls	
	Construction permits and approvals	
	Permit to take culture or brood stock	
	Permits to alter terrain or water ecosystem	
	Planning approval from local government	
	Discharge permits	
	Other (specify):	
(A5) Are there deadlines beyond	Yes, silence is consent	0

which an application is considered to be automatically either approved or denied (silence is consent or silence is denial rules)?	Yes, silence is denial	0
	No	1
(A6) What is the legal time limit on responsible bodies to issue required permits or licences (in days, longest procedures)?	If days<365, days/365, else 1. Or indicate if no legal time limit for approval	
(A7) Is there a simplified permitting or notification procedure for SME's or activities with low risks, such as shellfish?	Yes	0
	No	1
(A8) Do permits and licences require renewal?	Is there a specific threshold? (not scored)	
	Yes, each licence has its own independent expiry and renewal timeline	1
	Yes, but renewals are done in a “one-stop shop”	0.5
	No, they are only subject to revocation for violations	0
(A8.1) If Yes, what is the average duration of licences in months?	0<24(1); 24<48(0.5); 48<72(0.25); >72(0) (or indicate if data not collected)	
(A9) How many licences are currently undergoing assessment?	Please enter a number (or indicate if data is not collected):	0
(A10) How long, on average, does it take for new enterprise to gain approval to operate?	Average duration, months (or indicate if data is not collected):	if n>12(1), else n/12
(A11) What is the success rate of the full process for new enterprise?	Please enter a number (or indicate if data not collected):	
(A12) What does the licensing procedure cost a new enterprise?	Minimum cost (in domestic currency, or indicate if data is not collected)	0
	Average cost (in domestic currency, or indicate if data is not collected)	0
(A13) Do new businesses face any different licensing requirements or thresholds to established businesses (i.e. vintage differentiated regulations)?	Yes	1
	No	0
Administrative burden to entry = $6 \times (A1 + A2 + A3 + (A4 \times (\text{IF}(A4.1 \text{ is empty}, 1, \text{if not}, 0.5) + 0.5 \times \text{SUM}(A4.1)))) + A5 + A6 + A7 + (A8 \times (\text{IF}(A8.1 \text{ is empty}, 1, \text{if not}, 0.5) + 0.5 \times A8.1)) + A10 + A11 + A13$ / number of higher level responses		

Table A1.2. Market characteristics of licensing requirements

	Scoring of answers	
(B1) Is access to resources like land or water securable, such as through a lease?	Yes, long term	0
	Yes, short term	0.5
	No	1
(B2) Are these access rights tradable, that is can they be sold or rented to other entrepreneurs?	Yes, temporarily and permanently	0
	Yes, permanently	0.5
	Yes, temporarily	0.5
	No	1
(B2.1) If YES, is there an established marketplace for trading access rights?	Yes, established by government	0
	Yes, privately established	0.5
	No	1
(B2.2) If YES, are there transaction fees or clawbacks associated with trading of access rights?	Yes	0
	No	1
	Not known	1
(B3) Are these access rights a bankable asset?	Yes	0
	No	1
	Not known	1
(B4) Are permissions for environmental discharges securable, such as through a lease?	Yes, long term	0
	Yes, short term	0.5
	No	1
(B5) Are discharge rights or permits tradable?	Yes, temporarily and permanently	0
	Yes, permanently	0.5
	Yes, temporarily	0.5
	No	1
(B5.1) If YES, is there an established marketplace for trading discharge rights or permits?	Yes, established by government	0
	Yes, privately established	0.5
	No	1
(B5.2) If YES, are there transaction fees or clawbacks associated with trading of discharge rights or permits?	Yes	0
	No	1
(B6) Are discharge rights or permits bankable assets?	Yes	0
	No	1
	Not known	1
(B7) Are discharge rights or permits conditional on external conditions like total loading?	Yes	0
	No	1
(B8) Can rights be banked (moved forward or backwards in time) under specific circumstances (e.g. unused discharge rights used in following year)?	Yes	0
	No	1
(B9) Are auctions used to allocate any rights or licences? (if other processes are used please select no and more information will be requested)	Yes	0
	No	1
(B9.1) If Yes, are auctions used to allocate rights or permits?	Access to land: Access to water: Environmental discharges:	1/4 for each No

(B10) Can rights or licences be combined or divided?	Other:	
	For access to land	Yes 0
	For access to water For environmental discharges	Yes, subject to approval or conditions 0.125
	Other	No 0.25
(B11) Are rights or permits conditional on the use of specific production technology?	Yes	0
	No	1
$\text{Market characteristics} = 6 * (B1 + (B2 + 0.25 * \text{SUM}(B2.1) + 0.25 * \text{SUM}(B2.2)) + B3 + B4 + (B5 + 0.25 * \text{SUM}(B5.1) + 0.25 * \text{SUM}(B5.2)) + (B9 + 0.5 * \text{SUM}(B9.1)) + B7 + B8 + B9 \text{ aggregated} + B10 + B11) / \text{number of higher level answers}$		

Table. A1.3. Evaluation and review of aquaculture licensing regulations

Scoring of answers		
(C1) Is there a process to review the economic impact of aquaculture licences and permits?	Regular programme	0
	No regular programme, but ad-hoc reviews have taken place	0.5
	No	1
(C1.1) If YES, does this review explicitly look at the following aspects?	Administrative costs to government	1/3 for each "No"
	The overall administrative burden imposed on companies	
	Economic burden (impacts on growth, incomes, output, etc)	
(C1.2) If YES, are the results of this review publicly available?	Yes	0
	No	1
(C2) Do you have a specific process to collect information on the current administrative burden of aquaculture licensing?	Regular programme	0
	No regular programme, but ad-hoc reviews have taken place	0.5
	No	1
(C2.1) If YES, does this review explicitly look at the following aspects?	Number of licences issued	1/7 for each No
	Success rate of applicants	
	Number of applicants currently being processed	
	Average time to complete application	
	Number of public bodies involved	
	Average cost to applicant	
	Average duration of licence	
	Other:	
(C2.2) If YES, is the information collected in this process publicly available?	Yes	0
	No	1
(C3) Is there a process to review potential improvements to the administrative burden of aquaculture licences and permits?	Yes	0
	No	1
(C3.1) If YES, does this review explicitly look at any of the following aspects?	Possibilities of reducing the amount of requested statistical information (e.g. not asking the same information twice)	1/3 for each No

	Overlaps in different areas of responsibilities among administration levels/bodies Possibilities of introducing new instruments (e.g. demerit schemes, environmental bonds, offsets)	
(C3.2) Are the results of this review publicly available?	Yes	0
	No	1
(C4) Are businesses or stakeholders encouraged through a formal process to propose simplifications or flag particularly burdensome regulations?	Yes, on a continuous basis	0
	Regularly	0
	On an ad-hoc basis (no fixed schedule)	0.5
	No	1
Evaluation and review = $6 * ((C1 + 0.5 * C1.1) + (C2 + 0.5 * C2.1) + (C3 + C3.1) + C4 + (\text{count}(A8:A12 = \text{"Data not collected"}) / \text{responses}(A8:A12))) / \text{number of higher level questions answered}$		

Table A1.4. Institutions, planning and governance of agriculture

Scoring of answers		
(D1) Is aquaculture integrated into land use planning or marine spatial planning, for example through development master plans?	Yes, at national level	0
	Yes, at local level	0
	No	1
(D2) For Federal states only, are licences handled:	At the Federal level only	0
	At the state level only	0
	Both Federal and state bodies are involved in issuing licences	1
(D3) Is there a national aquaculture strategy?	Yes, with specific enabling legislation	0
	Yes	0.5
	No	1
(D3.1) If YES, does this strategy contain the following:	Statement of national objectives for the aquaculture sector	Score of 1/8 for each No
	Statement of vision or mission of aquaculture sector	
	Targets for output, employment or other economic activity	
	Measurable indicators for success	
	Process for review or evaluation of targets	
	Clear identification of parties responsible for achieving targets	
	A dedicated budget	
	A secretariat or other body dedicated to implementation	
(D4) Is there a mechanism for appeal of denial of licences or permits?	Other:	
(D5) Is there an independent ombudsman or auditor responsible for oversight?	Yes	0
	No	1
(D6) Are there clear assessment criteria for licence and permit applications?	Yes	0
	No	1
Governance characteristics = $6 * (D1 + D2 + (D3 + 0.5 * D3.1) + D4 + D5 + D6 + ((C2.2 + C3.2) / \text{nresponses}(D3 \text{ aggregated, } D4, D5, D6, C2.2, C3.2))) / \text{number of higher level questions answered}$		

Annex 2

Supplementary figures and results

Figure A2.1. Returned surveys and those included in the final analysis

(blue = survey returned and included, grey = survey returned but identical to other returns for the same country.region)

Figure A2.2. Individual aquaculture licensing indicators

Figure A2.3. How to read a boxplot

Further discussion of responses to questions that underlie the indicators

National aquaculture strategies and integrated planning processes are widely utilised governance characteristics

Aquaculture was reported to be integrated into land use or marine spatial planning in the majority of licensing systems reported on (68%), with integration predominantly occurring at the local (44%) as opposed to national (24%) level (QD1). National aquaculture strategies were reported to be in place in 89% of cases (Figure A2.4), however only 22% actually have specific enabling legislation in place (QD3), suggesting that this is an area where governance could be strengthened in many cases. The low level of specific enabling legislation may explain why the level of integration with planning at the national level is relatively low.

Figure A2.4. National aquaculture strategies are widely applied but a minority have specific legislation

The results were also generally positive when considering transparency of governance in licensing systems. The use of clear criteria when assessing licence and permit applications was reported to be overwhelmingly in place (80%, QD6), as were mechanisms for appeal of denial of licences or permits (82%,

QD4). Oversight from independent ombudsmen or auditors is less common though and not present in the majority of cases (58%, QD5).

Access to resources is often securable but these rights are relatively inflexible

Access to resources like land or water is securable, through mechanisms such as leases, in the majority of licensing systems (QB1, long term 49%, short term 16%, no 35%). However, in 39% of the cases where access can be secured the rights are not tradable, i.e. they may not be sold onto other entrepreneurs (Figure A2.5, QB2), which potentially limits flexibility in the system. The responses also show that the access rights are only known to be bankable assets in a minority of cases (QB3, yes 44%, no 11%, not known 44%), and is a possible constraint on the ability of businesses to raise capital.

Figure A2.5. Where securable, access rights are often not tradable

Permissions for environmental discharges are less frequently securable than access to land or water (QB4, no 68%, short term 19%, long term 13%), and where they are the rights are also predominantly not tradable (QB5, 94%, permanently 6%). Environmental discharge rights are also not known to be bankable assets in any instances (no 53% not known 47%). A further source of potential inflexibility in the licensing systems surveyed is that in all cases rights may not be moved forward or backwards in time under any conditions (QB8, no 94%).

The results also indicate that auctions are rarely used when allocating any rights or licences (QB9), with this approach only being applied in 9% of the licensing systems reported on. Where auctions are used it is currently only for allocating licences to access to water or for environmental discharges. Where auctions are not used businesses are most commonly required to apply for a permit and on a first come, first serve basis.

Annex 3

Comparing the aquaculture licensing indicators with existing measures of the regulatory environment

The aquaculture licensing indicators and existing measures of the regulatory environment show areas of similarity where expected, but not to the extent that they could act as substitutes

The indicators produced in this study are intended to be industry-specific measures. They have been created with the intention of helping identify both how approaches to aquaculture licensing compare across different OECD countries, and whether anything can be learned from this when the indicators are considered alongside independent measures of industry performance (such as recent rates of growth in production or environmental performance).

Do these aquaculture-specific indicators offer an improved understanding over what is available in existing national equivalents? A number of national level indicators relating to factors such as regulatory burden and policy stringency already exist (e.g. BEEPS, PMR) and industry level policy and licensing conditions may simply reflect (or be directly determined by) broader national policy.

To investigate this, the aquaculture indices were compared with a selection of these pre-existing measures (Table A3.1). This allows a closer look at whether the aquaculture indices provide new information and greater understanding of conditions in this specific industry, or whether measures capable of providing this information already exist.

The measures selected for comparison are a combination of indicators produced by the World Bank (WB)¹¹ and the OECD; those from the former provide national level information, at differing levels of complexity, on impediments to establishing or operating businesses, whilst those from the latter focus on the burden of environmental policies on the economy (BEEP) and environmental policy stringency (EPS).¹² The OECD product market regulation (PMR) indicator was also included as this incorporates a wide range of information on regulatory structures and policies and provides a measure of a country's regulatory stance (Koske et al. 2015).

¹¹ As part of the World Bank Doing Business project (<http://www.doingbusiness.org/>)

¹² The OECD Environmental Policy Stringency Index (EPS) is a country-specific and internationally-comparable measure of the stringency of environmental policy (Botta and Koźluk, 2014 and see <http://oe.cd/OQ>). Stringency is defined as the degree to which environmental policies put an explicit or implicit price on polluting or environmentally harmful behaviour. The index ranges from 0 (not stringent) to 6 (highest degree of stringency). The index covers 28 OECD and 6 BRIICS countries for the period 1990-2012. The index is based on the degree of stringency of 14 environmental policy instruments, primarily related to climate and air pollution.

Two of the WB indicators, Time required to start a business¹³ and (number of) Start up procedures,¹⁴ each focus on one specific component of the process of establishing a business. They are consequently highly specific relative to the data used to construct the administrative burden indicator used here. The remaining WB indicator, Ease of doing business,¹⁵ is a broad measure that incorporates a comprehensive range of information relating to the regulatory environment businesses face in different countries.

There is little correlation between these indicators (Table A3.1). Where statistically significant correlations do exist they are between the variables where this was most likely to occur (two with BEEPs and one with EPS) and all have the expected signs. Whilst this indicates that there is some overlap between these indicators, only a subset of the aquaculture indicators are correlated in each instance. This suggests that the aquaculture indices are picking up information in the correct areas but that they are not the same.

Table A3.1. Little correlation with existing measures suggests that the aquaculture indicators provide industry specific information

	<i>Administrative burden to entry</i>	<i>Evaluation and review</i>	<i>Governance characteristics</i>	<i>Market characteristics</i>
<i>Burden on the Economy due to Environmental Policies (BEEP)_2014 (OECD)</i>	0.369**	-0.081	-0.277*	-0.014
<i>Ease of doing business_2015 (WB)</i>	-0.091	-0.079	0.012	-0.199
<i>Environmental policy stringency (EPS)_2012 (OECD)</i>	0.102	-0.087	-0.103	0.419**
<i>Product market Regulation (PMR)_2013 (OECD)</i>	-0.053	-0.168	-0.128	-0.250
<i>Start-up procedures_2015 (WB)</i>	-0.013	-0.055	0.076	0.053
<i>Time required to start a business_2015 (WB)</i>	-0.062	-0.124	0.028	-0.083

Note: Measures of correlation (Spearman) between the aquaculture licensing indicators and a selection of other indicators relating to regulatory policy or establishing a business (significance asterisks (*0.05, **0.01, ***0.001), n=57).

The aquaculture indicator for market characteristics picks up some of the national level tendencies to use market-based measures in licensing systems. The EPS index is strongly correlated (positive and statistically significant) with the aquaculture index relating to market characteristics (Table A3.1, Figure A3.1). This reflects the fact that the underlying focus of the EPS index is primarily policy instruments related to climate and air pollution, a number of which are market-based in nature.

¹³ Time required to start a business is the number of calendar days needed to complete the procedures to legally operate a business. If a procedure can be speeded up at additional cost, the fastest procedure, independent of cost, is chosen. The underlying assumption here is that a higher number (more time required) is worse.

¹⁴ This provides information on the number of procedures required to start a business, including interactions to obtain necessary permits and licences and to complete all inscriptions, verifications, and notifications to start operations. The underlying assumption here is that more procedures potentially increase burden.

¹⁵ Ease of doing business ranks economies from 1 to 189, with first place being the best. A high ranking (a low numerical rank) means that the regulatory environment is conducive to business operation. The index averages the country's percentile rankings on 10 topics covered in the World Bank's Doing Business. The ranking on each topic is the simple average of the percentile rankings on its component indicators.

When burden on the economy due to environmental policies are high administrative burden to entry in the aquaculture sector also tend to be high. Moreover, when governance in the aquaculture sector is well-developed, burden on the economy from environmental policies are generally seen to be low. The BEEP index is positively (and significantly) correlated with the indicator for administrative burden to entry and negatively correlated with the index for governance characteristics (Table A3.1, Figure A3.2). This finding appears to support the view that better governance is typically associated with reduced burden of licensing systems.

The aquaculture indices produced in this study capture more information than that contained in existing indicators (Table A3.1). The three WB indices were predominantly seen to have weak and non-significant correlations with the aquaculture licensing indices. The absence of significant correlations here suggests that individually neither the highly focused WB indicators (time required to start a business or the number of start-up procedures) nor the broader WB indicator (ease of doing business) can replace the data used in this study.

Figure A3.1. Environmental policy stringency index (EPS) (OECD, 2012) plotted against each of the aquaculture indices

Figure A3.2. Burden on the economy of environmental policies (BEEP) (OECD, 2014) index plotted against each of the aquaculture indices

Annex 4

Growth rate calculation:

APR (average percentage rate) = $(\text{EXP}((\text{LN}(\text{value in last year of time series}) - \text{LN}(\text{value in first year of time series})) / \text{number of years}) - 1) * 100$

Figure A4.1. Administrative burdens to entry plotted alongside APR in terms of domestic currency

Figure A4.2. Administrative burdens to entry plotted alongside APR in terms of quantity produced (t)

Limitation to the approach

The practical challenges associated with achieving robust quantitative assessments of the economic impacts of regulatory policy, and the limitations this consequently imposes on our ability to formulate concrete policy recommendations has been recognised in previous work reviewing assessments of regulatory performance (Parker and Kirkpatrick, 2012). While useful for providing a summarised overview of licensing conditions, aggregate index numbers can be relatively blunt tools for assessing at a national level what is a relatively complex and heterogeneous industry. The potential cost of gaining an aggregated overview is the inability to look in detail at any context specific factors that may be important in given situations. It is also possible that the number of observations in this dataset, and the issues around representativeness that can arise from non-responses in cross-sectional datasets such as this, have may have played a part in the findings observed here.

The observed distributions of data points in some of the Figures shown clearly illustrate how, in most cases, it is difficult to identify patterns or relationships between the indices calculated here and the rate of aquaculture growth over the last decade. Further work on the indices, that looks in more detail at what data is used to represent the attributes of licensing systems (factors considered, weighting), may determine whether this had any influence on the relationships observed. In addition, the sometimes high year-to-year variation in rates of growth needs to be considered and in the absence of more data it might be difficult to identify whether patterns exist.

Finally, the information collected for this work is primarily *de jure*, and mainly reflects the legal and procedural requirements of the system as it exists today. Changes in the regulatory system over the period for which aquaculture growth was calculated can also confound the results.

The structure of the analysis was strongly influenced by prior OECD work, specifically the construction of the BEEPS survey. This approach is based on indicators and correlations and is not perfectly suited to the question of interest, which was "does regulatory burden needlessly reduce growth rates of aquaculture in the

OECD?" With the benefit of hindsight, a growth model with a more robust economic frame would have been better suited to answer this question. However, poor availability of sector-level data for factors such as investment and technical change may still have limited the results.

High levels of aggregation is a problem in analyses of regulation in general, and resulting work often lacks the ability to clearly identify exactly which areas need to be reformed (Parker and Kirkpatrick, 2012). The benefit of the work undertaken here is as a first guiding step in a process of identifying which areas require reform. The context specific nature of an activity such as aquaculture production should also not be overlooked and finding appropriate ways to account for these differences in assessments is likely to play a part in improving our ability to determine how governance situations are influencing production.