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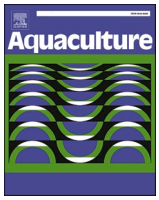

Serving the industry or undermining the regulatory system? The use of special purpose licenses in Norwegian salmon aquaculture

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ABSTRACT

Aquaculture governance can be challenging as a number of stakeholders have different objectives and visions for the industry. A license is an important tool in ensuring an orderly development of an industry, providing rights as well as obligations. However, the constraints imposed by a license can also prevent desirable activities. In the Norwegian aquaculture industry this has been addressed by creating special purpose license to promote some activities such as education and research, but which are operated in collaboration with commercial farms. While these licenses are not regarded as a part of the industry's regulatory system, the paper shows that that this can be a challenge as 17% of the current production capacity is in the form of special purpose licenses. This raises the questions of how well the special purpose license achieve their objectives or whether they undermine the regulatory system. This challenge is particularly pertinent in an industry with high profitability and strong barriers to further growth.

1. Introduction

The rapid increase in global aquaculture production raises complex governance issues, as it affects a range of policy areas, including rural or coastal development, use of natural resources, animal welfare, as well as international trade and food supply (Belton et al., 2020a, 2020b). Moreover, the governance system has strong impacts on the development of the aquaculture industry in terms of production and which technologies are used (Abate et al., 2016; Anderson et al., 2019). For governments, the selection of policy instruments is crucial in order to manage such industries to allow the opportunities created by new knowledge and technology to be exploited and simultaneously alleviate the multiple concerns of various stakeholders. A common tool is that some sort of license or permit is necessary to conduct the activity, and various rights and obligations can follow the permit (Hishamunda et al., 2014). Davies et al. (2019) report that almost all the countries (32 out of 36) included in their study have a permit-based authorization system for marine aquaculture. An aquaculture license will typically provide a right to produce fish (or another aquatic organism) at some geographical location, and may also contain limitations such as how much can be produced, on discharges or which production technologies can be used. Such instruments are also perceived as robust regulations and as central to a good stewardship of the marine environment (Davies et al., 2019). FAO describes the purpose of licensing as to ensure an orderly development of an industry whilst minimizing negative externalities (Hishamunda et al., 2014). The effectiveness of a licensing regime will, of course, depend on its objectives as well as the extent to which it is enforced and supported, and this gets harder as the number of objectives increase (Osmundsen et al., 2017; Abate et al., 2018). Guillen et al. (2019) and Lamprakis et al (2021) provide an interesting overview of EU aquaculture governance, showing how different parts of the governance system have different and sometime conflicting objectives.

In this paper, we investigate how the Norwegian license system is becoming increasingly complex as a number of *special purpose* licenses has become available. Norway is the world's 7th largest aquaculture producing country (Garlock et al., 2020), and is in many technological and knowledge dimensions regarded as leading (Smith et al., 2010; Kumar and Engle, 2016; Asche and Smith, 2018). The objectives of the

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Norwegian aquaculture governance system, and the requirements associated with the licenses, have changed considerably over the last 50 years in tune with prevailing ambitions and priorities (Hersoug et al., 2019). This is further complicated by the fact that the industry is not dealing with *one* license system, but several parallel systems with different objectives. In addition to the licensing system for ordinary commercial production, several types of *special purpose licenses* intended to fulfill specific industry and society objectives have been created. Special purposes one can obtain a license for include research, development, fish parks, slaughter cages, education, exhibition, and brood stock licenses. The special purpose licenses have in common that that they are awarded free of charge, they have limited time duration, and are established to support specific desirable purposes, for the industry or for society at large, which are difficult to pursue within the ordinary license system. As regulatory tools, these licenses have largely passed "under the radar", that is, they are largely awarded and operated with limited public attention and regulatory control. However, as we estimate that 21% of the total number of licenses and 17% of the total production capacity is due to various special purpose licenses, their impact is far from trivial.

With increasing salmon prices, the value of ordinary licenses has increased dramatically over the last ten years. Standard licenses of 780 tons of maximum allowed biomass (MAB) are currently traded at prices in the range of 150–200 million NOK (15–20 million USD), and increasing the MAB beyond 780 has similar prices on a per ton basis. That means that the salmon farmers have a rather optimistic view regarding future profitability, which may be reasonable given the high profit levels experienced by the industry over the last decade (Asche et al., 2018b; Misund and Nygård, 2018). Consequently, further expansion within the ordinary license system has become extremely costly. The special purpose licenses represent an opportunity to obtain cheap access to additional production capacity, as these licenses are allocated for free, given that one can meet the requirements associated with these licenses. Even though these requirements may be costly, the attractiveness of the various special licenses has increased considerably, along with the profitability of the industry as a whole. In this article we will investigate three aspects of the special purposes licensing systems.[1] The first is to what extent they serve their original purpose, the second is to what extent their design has unintended consequences for both the regulator and the holder of the license, and the third is how the special purpose license regime influences the ordinary license system.

The article is organized in seven sections. Following the introduction is a section on theoretical perspectives on aquaculture regulations and a short section on methods. Section 4 gives the background, briefly describing the ordinary license system, where future growth is regulated by what has been termed "the traffic light system". Section 5 offers a general introduction to the special purpose licenses, and a description of the various special purpose license arrangements. Section 6 contains the discussion and finally, Section 7 the conclusions.

2. Theoretical perspectives on aquaculture regulations

In general, natural resource governance is based on interventions that regulate human behavior (Berkes, 2008). These interventions are based on assumptions about how human activities affect natural resources and eco-systems (Pallson, 2006). Because nature is not directly accessible, it has to be represented through specific governable objects, which in turn become the foundation for defining interventions (Johnsen, 2017, Johnsen et al., 2009). Governable objects are constituted when the components and processes in an ecosystem are represented symbolically, as for example the carrying capacity of a specific site (locality) where several ecological considerations are expressed by a single indicator, the MAB. Specific techniques are used to translate and assemble the components and processes into bounded, homogeneous objects that can be measured, quantified, or modelled. This makes it possible to create specific intervention mechanisms for governance, as is done with e.g. with a fish stock, where the yield can be managed with respect to a given criterion such as Maximum Sustainable Yield (MSY).

A license is according to the dictionary "an official document that gives you permission to own, do, or use something" (Cambridge, 2020). Licenses have been used in Norway for more than 100 years to regulate industries exploiting natural resources such as fisheries and hydroelectric power production. Hence, stakeholders were quite familiar with this tool when the Ministry of Fisheries moved to limit the number of fish farmers in 1973. This is a process that contains an element of path dependency (Mahoney, 2000). Several authors have noted that administrative allocations are foreclosing the decisions of the market (Hernes, 1978; Olsen, 1983). However, administrative allocations do not eliminate competition, rather it changes the incentives on the competitive arena and changes firm behavior and outcomes as shown for salmon by Oglend and Soini (2020). As licensing system also makes public authorities responsible for the results of the allocation, it is critical how the authorities organize the allocation in terms of goals, criteria, and administrative processes, to achieve efficiency and legitimacy (Hersoug, 2005).

Until 1991, the governance system mandated owner operated companies as no one could hold a majority interest in more than one license. When aquaculture licenses became freely transferable from 1991, this was a step in the direction of using the market to a larger degree than before (Asche and Bjørndal, 2011). With increasing attention to the environmental aspects of salmon farming, the authorities over time became less interested in *who* did the farming and more interested in *how* they farmed. It was not a question of substituting one system for the other (from plan to market), but how to change the mix of the two steering systems. However, such changes do not happen haphazardly. They are mediated through *institutions*. Here, we are not going into detail about the many definitions of institutions, but suffice to say that many theories are based on rational choice theory, where institutions are seen as sets of positive (inducements) and negative motivations (constraints) for individuals, in which the individual utility maximization is acting as the dynamic element in the institutional set-up. Against this instrumental perception of institutions, it is possible to apply a sociological concept, where management institutions are *embedded* in a broader social structure (Polanyi, 1944; Granovetter, 1985). In this respect, the authors have found it fruitful to introduce a *social constructivist perspective*. A central element of this perspective is *framing*, which may explain why certain solutions have been chosen while others have been neglected or refuted.

In our case, aquaculture is regulated by two permits, which together constitute the aquaculture license. First the *production* license, granted for a certain number of tons of MAB (normally 780 tons, while 945 tons in the extreme north, due to slower growth), which is the focus of this paper, and which is the national government's main tool for regulating the industry. Second, the site or *locality* license determining where to farm. This has developed into each municipality's tool to regulate aquaculture, including whether it is an activity they will allow. At times this is controversial, despite the fact that municipalities receive compensation from the companies, and there are counties that do not allow aquaculture (Aanesen and Mikkelsen, 2020). Deciding where to place the aquaculture activities thus became part of marine spatial planning. Marine planning is a process whereby coastal space becomes framed as a governable object that can serve as a foundation for governance interventions (Johnsen et al., 2014; Lester et al., 2018, 2020). Hence, a locality is defined as a circumscribed area on the map with a specific *carrying capacity*, that is, the maximum amount of fish allowed, measured in tons. However, it should be noted that carrying

[1] We will not consider two of the special purpose license types; *fish parks* as there are only five, with a very limited MAB capacity and *slaughter cages*, as these contain fish for a very limited time and cannot be used for any type of ordinary production.

capacity is technology dependent (Tveterås, 2002). Both systems can be seen as social constructs, but as soon as they are established and fortified by institutions, laws, science, stakeholders and lobby groups, they may be difficult to change. The network created by various types of actors seems stabilized and may be taken as a fact, or as *the (only) solution*.

As pointed out by Scott (2014) the state's capacity to license is special, as it is linked to the state monopoly over legitimate coercive power. Consequently, regulating aquaculture is done for different reasons, but they all depend on being accepted as necessary and valid by most stakeholders (Jentoft, 2004). This is increasingly framed as a question of sustainability, i.e. *environmental, economic* and *social* sustainability. As demonstrated by Christiansen and Jakobsen (2017) and Aarset et al. (2020), there is considerable room for different interpretations in the discourses dealing with sustainability. While economic sustainability is largely the responsibility of the industry itself, the authorities have focused on improving environmental sustainability (Osmundsen et al., 2020a, 2020b), and area where there are continued challenges (Osmundsen and Olsen, 2017; Nygård, 2020; Pincinato et al., 2021a, 2021b). In the meantime, social sustainability has to a large degree been neglected, which is an important reason why the industry has struggled to obtain more and better space in the coastal zone (Hersoug et al., 2020).

3. Methods

To conduct this study, we have gathered data from a variety of sources, encompassing document analysis, interviews, and observations. The documents analyzed are mainly publicly available material related to the Norwegian aquaculture regulatory system in general and documents specifically related to the different license arrangements – ordinary and special purpose licenses – and evaluations and inspections of these. For the two types of special purpose licenses, development and research licenses, we have in addition studied award and rejection letters from the Directorate of Fisheries and/or Ministry of Trade, Industry and Fisheries. For the development licenses we have also studied documents from the consultation round in 2015 (consultation proposal and responses). The hearing round for development licenses lasted from June 12 to August 20, 2015. In total, the green paper received 27 responses. These include responses from public authorities (the Food Safety Authority, the Directorate of Fisheries, various ministries, counties, and municipalities), industry actors and their trade organizations, research institutes, universities, and interest groups.

We have also conducted group interviews with representatives from the Directorate of Fisheries, and with the Ministry of Trade, Industry and Fisheries, discussing topics related to both ordinary licenses and the system for special purpose licenses. For the exhibition licenses, we have in addition interviewed public case workers. Regarding the license systems for brood stock production and educational purposes, we have relied on internal as well as external evaluation reports, supplemented with interviews with actors directly involved. In addition, the material is supplemented with interviews with public authorities. Finally, we have relied on press clippings from three of the most central actors following the aquaculture sector; iLaks, E24 and Intrafish.

4. The ordinary license system

The Norwegian aquaculture industry is for all practical purposes salmon aquaculture, as more than 99% of the production is salmon, of which two species, Atlantic salmon (95%) and rainbow trout (4%) is produced.[2] Starting in the early 1970s, there were two main reasons for regulating the Norwegian aquaculture industry. The first was how much should be produced and by whom. Salmon farming was a risky business and overproduction could lead to boom and bust cycles (which happened anyway) and loss of private and public capital (Asche, 1997). The authorities also intended to use the industry as a tool to increase employment in rural coastal areas, which were facing severe challenges because the traditional fisheries and processing industry were contracting. Therefore, the right to farm fish was directed to certain individuals and regions. The measure used was *licensing* combined with an indirect limitation on the production volume. (Norwegian producers never had a *direct* limitation on the volume produced. Instead, they were regulated by the number of licenses, the size (volume) of the net pens and the maximum number of fish allowed in each net pen. This type of regulation was at best highly imperfect (Berge, 2001). The average production per standard license was around 1300 tons per annum in 2020, but with significant variation due to diseases and escapee events as well as productivity differences (Pincinato et al., 2021b). As of 2020, the government admits that production control is no longer a task for government regulations and should be left to the market (Meld.St.16. (2014–2015): 40)).

The second reason is related to the industry's environmental impacts. Salmon farming takes place in the water column which is *common property*, and emissions from the farms leads to environmental *externalities*. Externalities in this case refer to negative effects for other salmon farmers (salmon lice), effects on wild salmon (salmon lice and escapes) as well as effects on other users, such as fishers and recreational users (pollution).

The Norwegian system of salmon farming is relatively complex (Solås et al., 2015; Osmundsen et al., 2017; Hersoug, 2021). In the period 1973–2013, the government decided how many licenses that should be allocated, and also the maximum capacity per license, first by net pen volume, then by feed quotas and from 2005 onwards, by Maximum Allowed Biomass. The Ministry of Fisheries (now the Ministry of Trade, Industry and Fisheries) decided the criteria for each round of allocation. The concerns were of a varied nature. Some addressed formal requirements and minimum standards to be eligible for a license, while applicants fulfilling the minimum requirements were put on an equal standing, and prioritization was done based on supplementary criteria. These were political goals that the authorities prompted the applicants to work towards or ensure (Hersoug et al., 2019). Over the years, this allocation system came in disrepute. Many applicants complained that the system resembled a "beauty contest", where the farmers promised to fulfill various political goals, such as increased employment, further processing, local investments, etc. However, these promises were never controlled after the allocations had been made.

In 2011–2012, a further expansion of aquaculture was not on the agenda. The Ministry of Fisheries and Coastal Affairs had received strong criticism from the Office of the National Auditor (Riksrevisjonen, 2012), regarding the management of the Norwegian aquaculture industry, and particularly towards controlling sea lice. In 2012, a planned expansion of 5% of MAB across the country had to be cancelled. Still, farmers had a strong desire to increase production, as prices were high with few problems on the market. The solution was the introduction of so-called "green licenses", with which farmers were given the opportunity to expand production if they developed and adopted new production methods that could reduce the problems of sea lice and escapes. The scheme was eventually relatively complicated, with three different groups of licenses (A, B and C), altogether 45 licenses. The Ministry wanted to embed regional priorities, maintain a diverse farming structure in terms of company size, and use both auction and allocation by fixed price. The environmental criteria were also differentiated (Hersoug, 2016).

The scheme was positively received by farmers as well as environmentalists. The farmers finally had a chance to expand, while the environmental lobby was satisfied with the prospects of new technologies and new solutions to the problems of sea lice and escapes. However,

[2] Salmon and trout are different species in the salmonid family, and farmers are free to choose which species to produce within the regulatory system (Landazuri-Tveteras et al., 2021). Moreover, they compete in the same global market (Salazar and Dresdner, 2021).

the administrative costs connected to this experiment were considerable, several decisions were subject to appeals and some ended up in court. When the production finally got on stream, from 2016 onwards, there was considerable uncertainty regarding the conditions. The politicians concluded; "Green licenses never again!" (Hersoug, 2016).

Time was ripe for a new system, where growth should be based on objective criteria. The new system, termed *the traffic light system*, was based on the recommendations from the Area Committee (2011), recommending specific production areas, where growth could be decided based on environmental indicators. Much of the development work was done by the Institute of Marine Research (IMR), serving as the government's main advisor. In the end, it was decided to use only one environmental indicator, namely salmon lice (Osmundsen et al., 2020a, 2020b). Other indicators, such as emissions, escapes and mortality were considered, but discarded, due to lack of specific, objective indicators.[3] The coast was divided in 13 production areas (Fig. 1), where the number of sea lice, affecting the wild salmon and trout, would be decisive for further growth. In green areas, growth could be 6% every second year, in yellow areas the production should be kept stable, while in red areas production had to be reduced by 6% (Production Area Regulation, 2017). New capacity was to be auctioned or sold to a fixed price, reflecting real prices. Most salmon companies were rather skeptical regarding the scientific backing of the system, being based mainly on models, but the system was grudgingly accepted, largely for lack of other alternatives (Nicholls, 2017). However, at last there was now a predictable system for growth, based on objective criteria, which in principle reduced political discretion.

The system was implemented from 2017 onwards, while in the first round, salmon farmers in the red areas were not required to reduce their MAB capacity. This was considered a trial period, fine-tuning the system. However, from 2020, the scheme was fully implemented, implying a 6% reduction in red areas. Most farmers accepted the designation, while farmers in one area has sued the state, questioning the legality of reducing MAB for all licenses in an area.

5. The special purpose license system

The different special purpose licenses have been established at different times and with different purposes. Brood stock licenses were established to regulate the production of roe and milk from specific strains or fish with a high breeding value. Educational licenses are awarded to vocational schools or universities to facilitate recruitment and competence development by ensuring proper teaching of aquaculture practices and regulations, but are normally operated in collaboration with a commercial farm. Research licenses are intended to develop knowledge that can benefit the whole industry, and were primarily meant to be afforded to research institutions (Salmon Allocation Regulations, 2018). Exhibition licenses are meant to strengthen the public's knowledge of aquaculture, and are normally owned and operated by commercial farms. Development licenses are meant to encourage large-scale innovations and while established aquaculture companies are central to most of the afforded licenses, the actors involved also include new players. While ordinary licenses have been allocated according to specific political goals, there are no social considerations behind the allocation of special purpose licenses beyond the specific purpose.

In Table 1 we show the number of licenses and the attached capacity, measured in tons of Maximum Allowed Biomass for the different special purpose license types as well as ordinary licenses. As can be seen, there are 280 special purpose licenses compared to 1057 commercial licenses, representing 21% of the total number of licenses. However, they do not make up more than 17% of the MTB as the MTB of some of the special purpose licenses are smaller than the standard 780 mt.

In contrast to the ordinary licenses, special purpose licenses are not limited in number and, with the exception of a few licenses granted prior to 2011, they are all limited in time. Development, brood stock, and research licenses are granted for up to 15 years, and exhibition licenses up to 10 years. The Directorate of Fisheries grants licenses for special purposes following an administrative assessment. The licenses can be renewed based on a new assessment, or in the case of development licenses converted to ordinary licenses. Applications for licenses and renewals are received and assessed continuously, with the exception of development licenses, which were only open for applications in the period November 2015 to November 2017 (Directorate of Fisheries, 2020b).

A consequence of a continuous process of granting licenses is that there is no limit to the maximum number of licenses within each special purpose category. The special purpose license system can accordingly be said to be in continuous change. The number of licenses, the duration and biomass for these will vary over time, as some will be prolonged, some will expire, and new licenses will be awarded. This is unpredictable for both industry and authorities.

Another common feature of the special purpose licenses is that they are awarded free of charge. This means, naturally, that they are more in demand when the possibilities of growth within the ordinary licensing system is limited and costly, while the industry's profitability gives strong incentives to grow. The value and profitability of the various special purpose licenses will differ and cannot be directly compared to the value of an ordinary license. While many of the special purpose licenses can be operated almost on the same terms as ordinary licenses, they cannot be included in the company biomass, and fish from special licenses cannot be mixed with fish from other licenses. As some special purpose licenses have a shorter duration and less biomass, profitability will also decrease compared to ordinary commercial licenses. Time constraints create an uncertainty and will also to some extent reduce the value of the permit, compared to the ordinary licenses granted in perpetuity. Moreover, special purpose licenses also have an additional cost related to the tasks and activities they will carry out (exhibition activity, educational activity, research activity, development of new technologies, etc.). These extra costs vary and depend largely on what the holder of the license has committed to in the license application. Investigations attempting to reveal the actual profitability of these licenses have been unsuccessful, since license holders do not keep separate accounts for special purpose licenses.

5.1. Brood-stock production

In the late 1960s, a breeding program started by collecting samples from 40 different rivers in Norway. The material was stored by the Norwegian Agricultural University's research facility at Sunndalsøra (Thodesen and Gjedrem, 2007). Ten years later, in 1982, Akvaforsk (belonging to the Agricultural University) took the initiative to establish a national breeding program, and in 1985 a new research station was established at Kyrksæterøra. Both stations were granted permanent brood stock licenses. Furthermore, licenses for brood stock production were granted to local chapters of the salmon farmers' own interest organization; Norwegian Fishfarmers' Association (*Norske Fiskeoppdretters Forening*). These were operated by commercial companies, on behalf of the local chapters. The 13 licenses were originally granted for 8000 m^3 volume, later extended to 12,000 m^3 or equal to the present standard license of 780 tons MAB.

The first regulation for brood stock production appeared in 1986, to be revised in 2005. The number of brood stock licenses had not changed much, while the industry had changed dramatically (Hovland et al., 2014). Brood stock producers complained about unequal treatment and

[3] This is also partly a function of these other indicators not measuring sufficiently critical issues. Pincinato et al. (2021a, 2021b) show that respectively mortality and escapes are at moderate levels and not increasing, and nutrient emissions are controlled only at the location level (Asche and Bjørndal, 2011) as it does not have a significant impact as it can in other environments (Nielsen, 2012; Jacobsen et al., 2016).

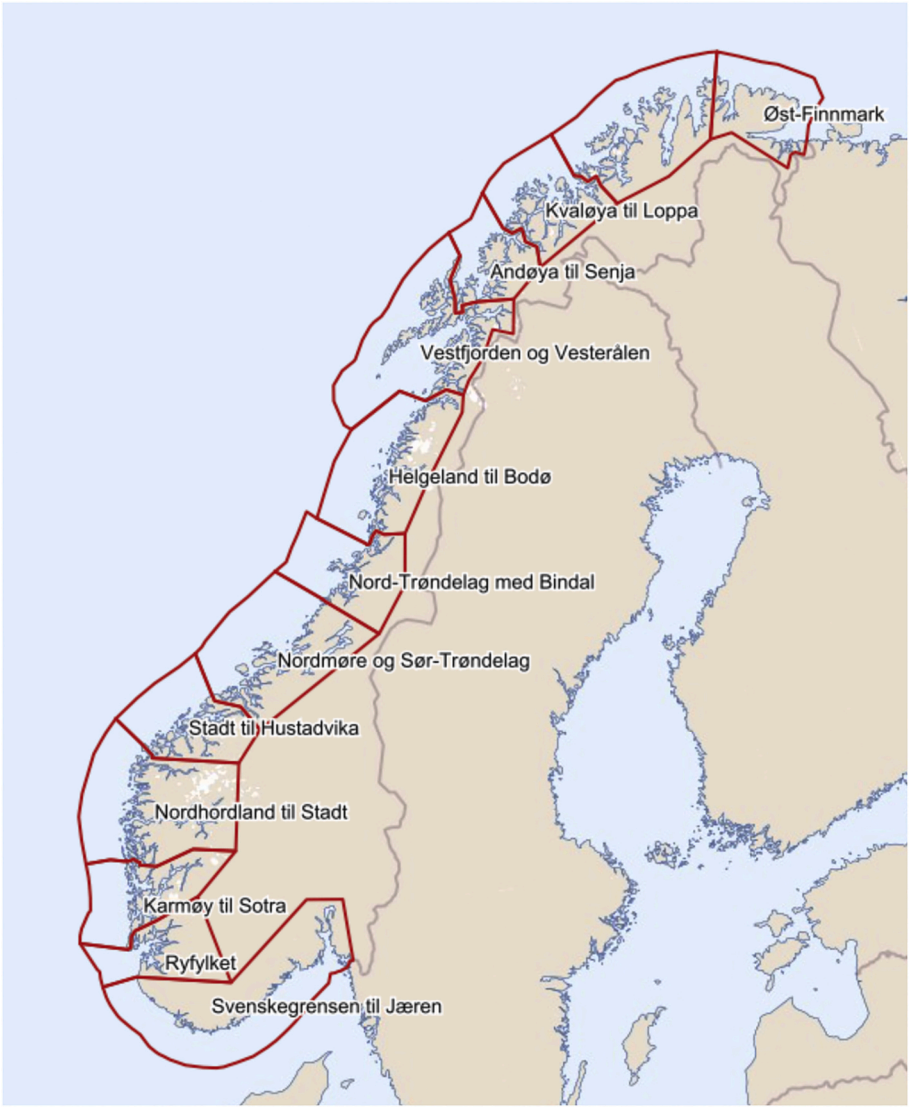

Fig. 1. Production areas for salmon and trout in Norwegian aquaculture.

Table 1
Special licenses in numbers and MAB capacity (October 2020).

License arrangement	Number of licenses	MAB capacity
Brood stock	40	30,235
Education	15	8753
Research	94	68,628
Exhibition	28	19,880
Development	102	80,340
Total special purpose	279	207,836
Total commercial	1057	1016,540

Source: Directorate of Fisheries (2020a).

lack of predictability. Hence, when the new regulatory framework was introduced with effect from 2008, the brood stock industry should be profitable, securing the best quality roe in sufficient quantities in all salmon producing regions. Special licenses for brood stock production were to be granted for up to 15 years duration. Each license had to guarantee delivery of at least 35 million roe per year, based on selected production lines. Each application is evaluated by a scientific committee, with representation from scientific institutions as well as the producers. By the end of 2019, there were 41 commercial licenses (salmon and trout), run by 13 different companies with a total capacity of 30,235 tons MAB. In addition, there are seven licenses belonging to research institutions, with a total capacity of 790 tons of MAB.

When the system of brood stock production was evaluated by the research institution Nofima in 2014, the general message was that there had never been surveillance and control with the specific conditions set up for brood stock production. Consequently, the Directorate of Fisheries undertook a preliminary control in 2015, while a full-scale revision in 2018, showing important deficiencies in terms of reporting. Eight of the 13 companies did not have an approved operational plan, and seven did not fulfill the requirements listed in the license regulations, including the production requirement of 35 million fertilized eggs per year. The reactions were mild, and no company lost their license. According to the Directorate "The Directorate of Fisheries will in the future have increased focus and supervisory activity with regard to adherence of the special requirements given for brood stock licenses" (Directorate of Fisheries, 2018:13).

The brood stock producers are heavily concentrated. Two companies (Aquagen and Salmobreed) control approx. 70% of the Norwegian market. For salmon brood stock, two other companies, both large and vertically integrated, control the remaining licenses (Salmar and Mowi) while for trout brood stock two smaller companies are also involved (Osland and Ilsvåg). This means that ordinary producers have access to different brood stocks, which is considered an advantage in terms risk

and security for delivery. Brood stock production involves three different tasks: breeding, production of roe and securing the breeding core. Brood stock producers are required to have both sea and land facilities, which makes this activity costly, and it seems difficult to establish new companies and new brood stocks (Aarset and Borgen, 2015).

5.2. Educational licenses

The educational license scheme is intended to "facilitate recruitment of personnel with relevant competence to the aquaculture industry," enabling schools to offer realistic, attractive, and good vocational education in aquaculture (Directorate of Fisheries, 2020c). As with research licenses, the educational license scheme is one of the oldest within the special purpose license system, with the oldest active license being from 1984. For the industry, these licenses are primarily important in ensuring education and improving opportunities to contribute to, and create better, recruitment opportunities for professionals in aquaculture. The licenses are reserved for educational institutions, mainly at upper secondary or college/university level that can offer participants a certificate following the completion of the program. Commercial actors cannot apply for or own educational licenses. However, it is common for these licenses to be operated by commercial salmon farming companies, and profits shared according to private business agreements. With a few exceptions, one license is granted per educational institution, most often for 780 tons MAB. Licenses that have been granted or changed since 2007 are limited to 10 years duration.

In 2019, the Directorate of Fisheries conducted an audit of 13 of the educational licenses, where the main finding was that the scheme worked well and according to intentions. The infractions were mainly related to lacking implementation of the educational license requirements in the internal control system (Directorate of Fisheries, 2020d). The audit report also shows that although the agreements between the school and company operating the license differ somewhat in terms of distribution and requirements, all schools found they had a good working collaboration with their industry partners. The report also shows that both industry actors and the schools saw the collaboration as beneficial in several ways. For example, it is said to lead to closer and more committed contact and collaboration, better access to modern equipment and opportunity for practical teaching and training at modern locations. Furthermore, the students become better acquainted with working life, as well as gaining insight into parts of the industry that go beyond the educational license (e.g. hatcheries, slaughteries, and research and development). Commitments in the collaboration agreements also help to secure the students apprenticeships after completing the program.

Findings from interviews pertaining to the special purpose license system, which we conducted with industry actors, support the findings in this audit report. It is clear that the industry actors welcome these licenses and would like to see more schools with aquaculture education programs. Although the educational licenses have existed for over 30 years, there are relatively few active licenses. Looking at the number in a geographical perspective, there are very few schools with their own license compared to how large and scattered aquaculture production is in Norway.

As with other special purpose licenses, economic figures are hard to obtain. However, a recent example may illustrate the importance of the collaboration agreements. A small secondary school have over the last five years received between 7 and 17 million NOK each year as their share of the profit from the educational license. The operating company on their side claims that the arrangement has been highly beneficial for them as well, as they have been able to increase production. The company in this case operates two educational licenses, two research licenses and one exhibition license, which together increase the company's total production with 30% (E24, 2020). This also improves scale economies downstream for processing and marketing (Asche et al., 2018a). Other secondary schools with similar collaborative arrangements report of lucrative agreements, allowing them to invest in infrastructure, including research vessels. In 2019, a new private educational provider of aquaculture education has received a license, thus supplementing the public offer.

5.3. Research licenses

Special licenses for research purposes were introduced in 1986, to support companies in solving the various challenges of the aquaculture industry. The research licenses shall contribute to the development of knowledge that benefits the aquaculture industry as a whole, within areas such as modes of operation, technology, biology, nutrition, fish health, and fish welfare. The research licenses may have a maximum duration of 15 years, but the duration for each license, as well as the size of the biomass involved, shall be determined for each project individually. Applications are evaluated by a council of three representatives from the research sector and the industry, with the authority to make recommendations to the Directorate of Fisheries during the treatment of applications.

The guidelines for the allocation of research licenses, issued by the Directorate of Fisheries (2019a) and updated at different intervals, state that the scheme is primarily reserved for research institutions at university and college level. In special cases, other private or public institutions may, however, be granted research licenses, when the biomass is a necessary and integral part of a research project. In such cases the scope and duration of the research project must be described in detail, and it is required that the research is carried out in cooperation with an external research institution at university or college level, which assumes responsibility for the scientific content of the research. The license and the associated fish are owned by the responsible applicant, and the license cannot be rented out. In order to be approved, the license must also be associated with a specific locality. The responsible applicant must further document access to sufficient expertise to implement and carry out the research project. It must be documented that the project may produce new knowledge that is relevant for the industry as a whole. A detailed time schedule and a plan for funding, organization and management must be provided, and the proposed duration of the project, as well as necessary biomass involved, must be argued for. It is also emphasized that the knowledge produced should be made publicly available.

As of October 2020, a total of 94 research permits are in operation, with a total standing biomass of 69,408 tons. The number of licenses that have been granted over the years is difficult to determine, since licenses that are no longer in operation are taken out of the aquaculture registry. The licenses are categorized into five different topics - breeding and genetics, fish health, feed, technology and operation, ecology and welfare, and a separate category for research institutions. The latter category thus contains the permits owned by research institutions. Only 11 of the 94 licenses fall into this category, which may seem a little surprising, since the regulation states that the licenses should primarily go to research institutions. These permits typically have a long duration, but often a relatively modest biomass, and can be used for research on different topics. The other licenses are designated for research projects within a specific topic. These have a shorter duration, but the biomass involved is generally of the same size as for ordinary commercial licenses (780 MAB).

In the fall of 2019, the consulting firm Deloitte (2019) conducted the first evaluation of the system of research licenses, commissioned by the Directorate of Fisheries. The mandate for the report was an assessment of the performance of the research license system, over the period 2005–2018. The report provided a number of critical inputs as to how the system is designed and to how it is currently practiced. The report documents a sharp increase in applications for research licenses in the period examined, especially in the period after 2012, where profitability in the industry was high. For the entire period, 48% of applications had

been granted. The report rated the scheme as good, judged by its intentions, and the projects examined generally seemed well suited to help solving the challenges of the aquaculture industry. At the same time, this is difficult to know, since publication of the results from the projects proved to be minimal, despite publication of methods and results having been made clear as a prerequisite for being assigned such licenses. The annual reporting to the Directorate has been inadequate, and in many cases completely missing, without this having had any consequences for the holders of the licenses. Of the 16 projects examined in the report, no scientific publications had been produced from 9 of them. One project had resulted in 13 scientific publications within the thirteen-year period examined, almost as many as the rest of the other projects combined. This project was owned by a research institution, as opposed to the other 15 projects. To the extent that something had been published from the other projects that were examined, it was mainly through participation in seminars and conferences.

In the wake of the Deloitte report, the Directorate of Fisheries (2019a) published updated guidelines for the future allocation of research licenses. These are significantly more extensive than the previous ones, and many of the critical remarks from the Deloitte report appear to have been accounted for. While the revised guidelines are not very different in substance from the earlier versions, they go further in clarifying the purpose of the research licenses, and what distinguishes these from ordinary commercial ones. It is clarified that the purpose of the scheme is to support projects that involve too much risk to be carried out within the ordinary license system. Food fish production is not the main purpose of these licenses and is considered a side effect of the research activity. The proposed duration of the project, and the size of the applied biomass, shall be scientifically justified, and the competence and responsibilities of the institution and personnel that is scientifically responsible for the experiments shall be thoroughly documented. A plan for the size and development of the biomass during the research project must also be drawn up and must clarify how much commercial production is planned each year.

It is thus clear that the Directorate has considered the criticism in the Deloitte report, and the concern that the research permits do not differ sufficiently from ordinary commercial licenses. The most important clarification in the updated guidelines may apply to reporting of the results from the research. The responsible license owner of the research shall deliver annual reports on standardized forms, where method, implementation, results, conclusions, and evaluation shall be presented. It is emphasized that the purpose of the reporting is that others who are not involved in the experiments can evaluate methods, hypotheses and experimental design. It is clearly expected that knowledge created using the research licenses will be published scientifically, in peer-reviewed journals, and made available through open publication databases.

5.4. Exhibition licenses

Exhibition license is a relatively new type of license scheme, and was established with the aim of improving general knowledge about aquaculture (Salmon Allocation Regulations, 2018, §22). To obtain an exhibition license, an application must be made to the Directorate of Fisheries, who conduct an overall assessment and decide whether the license should be granted or not. Important criteria include that activities are adapted to accommodate visitors and made suitable for dissemination, proximity to other tourist destinations, and distance to other aquaculture activities with exhibition centers. As these licenses cover production of salmon and rainbow trout for exhibition purposes, this can include both a sea facility, where the license is being operated and an exhibition center (preferably on land or on a fleet) where guided tours are offered to visitors. The specific content and activities offered varies between different exhibition centers, but they are all required to communicate knowledge about modern aquaculture production (Directorate of Fisheries, 2019b).

The first exhibition licenses were granted in 2007, and the first center to open to the public is still in operation. In the following years, several exhibition centers have been established, and new licenses are continuously granted. As of October 2020, there were a total of 31 exhibition licenses, all co-located with commercial licenses (Directorate of Fisheries, 2019b).

From interviews with the Directorate of Fisheries, and as reported in media (ilaks.no, 2014; Gauteplass; Gauteplass and Olsen, 2019) there is much interest in exhibition licenses. The Directorate has received far more applications than expected, especially in connection with other award rounds for ordinary licenses. However, the processing of applications is lengthy, especially in recent years, even though large extra resources have been allocated to the Directorate of Fisheries. In the last few years, the processing time has been about 1.5 years, and few are accepted (intrafish.no, 2016). The Directorate also see an increase in applications from larger (i.e. more resourceful) companies. In recent years, the Directorate of Fisheries has also changed its focus somewhat in how they assess applications. Having previously been adamant that the exhibition facility at sea must be accessible to visitors, it has in recent years become more important to ensure a larger audience. Therefore, applications for establishing exhibitions centers in big cities have also been granted, despite having no access to facilities at sea. This also relate to the issue of whether the exhibition centers receive many visitors. Numbers of visitors vary from 340 to over 7000 per year. On the other hand, numbers of visitors is perhaps not the most relevant indicator for how well these serve their purpose, since a large number of visitors may receive a short introduction to aquaculture, while smaller numbers may get involved in lengthy excursions and receive in-depth knowledge of aquaculture production.

The conditions for the license are strict, and the Directorate of Fisheries must make a discretionary assessment of each application. As more licenses are being granted, it becomes even more difficult and only the best applicants manage to obtain a license. In theory, anyone can apply for an exhibition license, but as of today, it is primarily fish farming companies that also produce salmon with ordinary licenses that own, and apply for, the exhibition licenses.

In 2018, the Directorate of Fisheries conducted an audit of 20 exhibition licenses (Directorate of Fisheries, 2019c). This is the first time that the Directorate of Fisheries has carried out targeted inspections and control of the special conditions for these licenses. The main conclusion of the audit report was that the system largely functions as intended, with most of the activities adapted for the public, particularly suitable for dissemination, and helping to strengthen the public's knowledge of aquaculture. However, there were some exceptions, including a notice of withdrawal of one license. In addition, a total of 65 non-compliances were registered during the audit. These non-compliances primarily concerned that the exhibition centers to a limited degree were integrated in the companies' internal control system.

5.5. Development licenses

The newest category of special purpose licenses are the *development licenses*, introduced in November 2015. This was a temporary arrangement, where licenses could be awarded to projects involving significant innovation and significant investments. When the application period expired in November 2017, the Directorate of Fisheries had received 104 applications, asking for 892 licenses (standard 780 tons MAB). To put this into perspective, this equals 85% of the total number of ordinary production licenses. As of 2020, 20 companies have been awarded 103 development licenses to a total capacity of 80,340 MAB.

Like the research licenses, development licenses can be assigned with a duration up to 15 years, with allocated MAB up to 780 tons. There are no limitations on maximum number of licenses for each project, but the Directorate of Fisheries can and in several cases do award less production capacity than what was applied for. Only 3 out of 20 successful applicants received the number of licenses they applied for. Results from the projects must be reported annually and will be publicly accessible.

Based on the project plan, target criteria shall be set for the project and its milestones, and the appropriate criteria for this should be suggested in the applications. These criteria will be used in the assessment of the application, in later revisions of the license (if granted), and it will also be the foundation for approval to convert the licenses to ordinary licenses if the target criteria are met. This does not imply that the successful applicant is committed to use the project technology. If for example, open net pen production is more profitable, the license holder is free to use this technology, even if such a return may result in worsened environmental conditions. The owner of the development license (s) can apply to convert these to ordinary licenses for a fixed price of NOK 10 million per license. Given the market price for ordinary licenses, this is a strong subsidy of innovation. The first application of converting development licenses to ordinary licenses was accepted in 2020.

A review of the guidelines for assessing applications shows that they open for much discretion, especially in assessing innovation and uncertainty. In practice, it is therefore up to the Directorate of Fisheries to decide how challenging it should be to obtain a development license. The process of evaluating all applications took far more time than anticipated and indicates that the authorities was not prepared for the magnitude and complexity involved in assessing these applications. Particularly two conditions are central in the assessment process; that the projects should involve *significant innovation* and *significant investments*. The technological solutions also need to differ from solutions that have already been granted development licenses. If two similar solutions meet the requirements, but are considered too similar, the first application will be granted, while the second will be rejected. An important but somewhat challenging part of evaluating the innovation in each project is that in addition to an innovation element there should also be some form of uncertainty attached to the expected result. The assessment of innovation is the first and most important criterion. If the application does not meet the criteria of significant innovation, the application is rejected, and the Directorate ends their assessment. If the technology is evaluated as significantly innovative the Directorate proceeds with an evaluation of the project's need for investments and biomass to test the technology, and then allocate a necessary number of licenses.

Development licenses are intended to be a risk reducing arrangement for the large projects that the industry itself cannot or will not take the risk to carry out on its own, and it is therefore required that significant investments are made. First and foremost, this means considering the real size of the investment, but the Directorate can also consider the applicant's ability to make such investments. Since the development licenses are convertible to ordinary licenses if successful, it is the value of granting a commercial license that is the government's contribution to the development projects.

In assessing significant investments, the investment amount is set against the need for biomass and the value of the licenses sought. The value of a license is based on an estimated value of a commercial license, and until June 2018, the Directorate of Fisheries estimated this to approximately 50 million NOK. After June 2018, this changed to approximately 150 million NOK (due to the results of the auction of increased production capacity per license conducted in spring 2018). Hence, the "rules of the game" changed during the application processing. Most applications processed after June 2018 received a different assessment of the investment grade (and therefore, the number of possible licenses) compared to those considered before this time. This "game changer" happened after the application deadline had expired and created a possible bias in applications evaluated before or after.

Of 104 applications, 82 have been rejected, and 70 of these applicants have appealed the rejection. By October 2020, three years after the last applications for development licenses was submitted, 30 complaints are still pending. Many companies claim their application has been rejected due to wrongful discrimination, often referring to the Directorate's evaluation of the actual project innovation.

6. Discussion

As described by Hersoug et al. (2019, 2020), the ordinary licensing system for salmon aquaculture in Norway now seems consolidated. Licensing is primarily used to control externalities, that is, effects on the environment and on other farmers. Industry as well as public authorities agree that licenses are essential in regulating the industry, and they are both using the same "currency", namely maximum allowed biomass (MAB) (Hersoug, 2021). The special purpose licenses can be considered a part of the larger system in that they have a similar form, but they also constitute different systems in that they are governed by separate rules. The special purpose licenses are by no means a marginal activity (see Table 1). While the ordinary licenses are strictly regulated with respect to growth, several of the special license arrangements are in principle open-ended, with no limits in terms of numbers of licenses that can be awarded and thus total capacity.

When the operation of these special purpose license arrangements for so long has gone "under the radar", one explanation is that all parties involved benefitted. Exactly how profitable the various schemes are is difficult to calculate, as most special licenses are operated by vertically integrated companies, and the fish involved are produced together with the regular commercial production, often at the same locations. As demonstrated in the case of exhibition licenses, there is hardly any exhibition farm showing a separate account for the exhibition licenses. The actual license may be included in the companies' accounts, while the exhibition farm is organized as a separate company, most often with no income, except for the entry tickets. For the educational and research licenses, the agreements, specifying sharing of risks and profits between the license holder and operating companies, are often considered business secrets, and not made publicly available.

While there may be limitations to the information available for several license agreements, we can still make gross calculations. Anticipating that a standard license of 780 tons MAB is able to produce 1200 tons of salmon per year, with an average profit margin of 20%, total income should be in the order of 70 million NOK and total profits ca. 15 million NOK on average per license, although there may be large variations. In the case of educational and research licenses, this profit has to be divided between the holder of the license and the commercial company operating it, while in the case of brood stock licenses and exhibition sites, the holders of the license may have committed themselves to heavy investments. Nevertheless, the keen interest for such licenses shows there is a potential gain, which is larger than buying extra capacity through auctions or by acquisitions. Hence, the special purpose licensing regime can be characterized as *a back door to increased production.*

There is no doubt that the system of special purpose licenses has catered for shared needs, both in industry and in society at large, such as brood stock production, research and education. For such objectives it is, in the end, a question of *how many licenses that are needed to cater for these special needs*. Regarding brood stock production, it seems like the present producers are producing sufficient eggs for the industry, although there may still be a shortage in certain regions, especially in the north. The demand for regional self-sufficiency in terms of egg production may require more licenses in the future. However, the supply of eggs is now primarily considered a responsibility of the private brood stock companies involved, although there may still be strategic reasons for state interventions (Aarset and Borgen, 2015; Borgen and Aarset, 2016).

In terms of educational purposes, 13 schools and 3 higher education institutions have a license and again, it is a question of how many recruits are needed. At present, more schools could produce more qualified candidates. Regarding the research licenses, there seems to be serious shortcomings regarding reporting (open, public access) and some disparities regarding who is actually responsible for the research; the technical institution where the research takes place or the scientific research institutions being officially responsible. Although both partners

seem to benefit from the system, there is a lack of transparency, which must be addressed in order to save the legitimacy of this arrangement.

The use of exhibition licenses has been the most evident way of obtaining a cheaper ticket to increased production than ordinary licenses. At present, there are 31 exhibition centers and several new applications pending a decision. The new centers are becoming more elaborate and costly, but the number of visitors is at best very moderate. While the original idea may have been basically sound (providing knowledge about an unknown industry), further expansion of exhibition centers may be questioned, both from a socio-economic as well as a strategic point of view. More knowledge may improve the standing of both the product and the industry, but the main problem for the industry and its reputation is still the lack of environmental and social sustainability (Olsen and Osmundsen, 2017; Osmundsen and Olsen, 2017; Osmundsen et al., 2020a, 2020b; Alexander et al., 2020).

The most valuable licenses to facilitate increased production has been the development licenses. These licenses can be obtained by companies investing in new, large-scale projects, and they can later be converted to ordinary licenses when the project is completed and results reported by paying 10 million NOK (1 million USD). This has been considered a strong incentive, or subsidy, depending on the perspective. The preliminary assessment is that the system of development licenses has created many large-scale technological projects. Many of these projects have been able to draw on technologies developed in the petroleum and shipping sectors, creating work and employment for shipyards and companies facing the downscaling of the petroleum industry. A critique is that the system is extremely favorable to the farming companies, thus forsaking important income to the state and the coastal municipalities. Some have also argued that this type of licenses just encourages solutions that in the next round can be used by important competitors, thus reducing Norway's comparative advantages (sheltered fjords with the right temperature and water exchange). This argument has been countered by showing that these new technological solutions may in themselves create a new export industry, much like the oil-related Norwegian equipment industry.

All public regulation measures may have unanticipated consequences. We have already dealt with the back door to increased production. The development licenses also have other implications, some of which may also influence on the ordinary license system. The first deals with capacity regulation in the traffic light system, which should be strictly regulated, based on environmental indicators. When the development licenses are being converted, however, there will be no guarantee that these licenses will continue with the developed technology, i.e. thus expected to reduce the risk of salmon lice and escapees. If the traditional technology is more economically attractive, the companies are free to run these licenses as ordinary open net pen production, thus contributing to the familiar environmental problems.

Second, due to the fact that the licenses have become so expensive, the authorities have been more cautious regarding the subsidy element. While two of the first projects received 21 and 8 licenses respectively, most of the latter projects have received one or two licenses, precisely in order to reduce the chances of being accused of subsidizing the salmon companies involved. This means that "the rules of the game" have changed in the middle of the process, which is normally considered unfair and politically untenable.

A third effect is the possibility of selecting *the least efficient projects*. When the Directorate of Fisheries adjusted the value of a commercial license from 50 to 150 million NOK, applicants had to increase their cost estimates, in order to reduce the subsidy element. In the end, the Directorate could end up by selecting technologies that are most cost demanding, and hence less cost efficient.

For all special purpose license systems, there is an incentive to what may be termed *goal displacement* (Bothe and Meier, 2002), in this case, to produce more fish than strictly required to fulfill the original goals. The fish can then be sold on the commercial market, to the benefit of both the license owners and the companies operating the actual production on their behalf. Within the present regulations, this is perfectly legal, but it is still a question whether this form of subsidy is the best option to reach the specific goals listed for each of the special purpose license arrangements. Economists would argue that some of these license arrangements produce expensive solutions, while at the same time reducing the state income from sale of licenses. This critique applies in particular to the development licenses, where the subsidy element is considerable (Vormedal et al., 2019).

In terms of administrative consequences, the first four special purpose license arrangements have been relatively easy to manage. Applications are assessed continuously, and for the research licenses the Directorate of Fisheries uses a committee to make evaluations and recommendations. For brood stock licenses and educational licenses, the number of applications per year is very limited, although closer control and supervision will demand more efforts from both the Directorate of Fisheries and from the Food Safety Authority. With research licenses, the picture is more complex. The number of applications is larger and increasing and the follow-up activities more demanding. This in turn, also affects the capacity of the Ministry, responsible for dealing with appeals. The most demanding scheme was the development licenses, where the Directorate of Fisheries had to hire new technological expertise to examine the complicated and comprehensive applications, in addition to seeking advice from external scientific experts. While the development licenses no doubt have improved the technical and administrative capacity of the Directorate of Fisheries, it is reasonable to argue that the attention has come with a cost, i.e. less capacity for the smooth running of the ordinary license system. All new license arrangements require additional administrative capacity, especially if complicated requirements are to be monitored and controlled.

7. Conclusions

The different types of special purpose licenses in Norwegian aquaculture were all established to serve special needs for the industry, as well as society at large. Most of the schemes were developed by the aquaculture authorities in close cooperation with the industry, the salmon farmers and their organizations. For years, these license arrangements have "passed under the radar" in discussions of the governance system, being considered as marginal in terms of numbers and capacity. However, by 2020, the special purpose licenses constitute 21% of the total number of licenses and 17% of the total MAB capacity. Hence, they are by no means a marginal part of the industry. When the Directorate of Fisheries finally decided to control the special purpose licenses, the general perception was that these arrangements have served the industry well and should be continued. However, there are at least two central aspects, which have not been scrutinized;

- that each special license arrangement has been evaluated separately while not accounting for its impact on total production and governance (effects on the traffic light system).
- the magnitude and importance of the cheap tickets to increased (commercial) production by getting around the ordinary license system

The answer to the rhetorical title of this paper is not clear cut. The special purpose licenses have clearly produced positive externalities for the industry as a whole as well as for the individual companies involved. At the same time, the number of special purpose license schemes and the significant share of production supported by these licenses may at the same time contribute to the undermining of the ordinary management system.

Based on our findings, we would recommend three general approaches in order to improve the administrative system: First, that all special purpose license arrangements are critically evaluated, to see whether they contribute to the ultimate goal of the whole management system. Second that the special purpose licenses have to be controlled

more regularly, to secure that the licenses operate in accordance with the conditions prescribed for these arrangements. Third, if the politicians prefer to continue with a system based on special purpose licenses, the main challenge is to address the shortcomings of the dominant production system, largely based on open net pens. The solution could be a second round of development licenses, but now strictly geared towards reducing environmental impacts using closed or semi-closed net pens. However, this would create a massive administrative workload of similar magnitude as the first round, which lasted three years (and is still not finalized). An easier solution would be to create a new separate license scheme for closed or semi-closed net-pens, with lower entry prices and a premium for existing open net pens farmers converting their farms to closed solutions. This has already been done for land-based production.

What are the more generic lessons from the Norwegian experiences? While the early success of Norwegian salmon farming was largely attributed to the cooperative spirit of the farmers and active state support for research, education and a protected sales system, later developments have changed the system considerably. Salmon farming has become industrialized and science driven, with a heavy concentration of farming companies as a result. Public management has changed accordingly, although the license system has remained nearly unchanged since 1973. Continuous productivity growth and innovation has been the main driver behind the growth of the Norwegian salmon farming sector (Asche, 2008; Tveterås, 1999; Bergesen and Tveterås, 2019), a feature the industry has in common with other successful aquaculture industries (Kumar and Engle, 2016; Guillen et al., 2019), although there is significant evidence this is slowing down (Iversen et al., 2020; Rocha-Aponte, 2020). The challenge when productivity growth is been slowing down is the difficult balancing act of how to cater for sustainable development, while at the same time encourage innovation. Seen from an administrative or a socio-economic perspective, it is not guaranteed that special purpose licenses are the best answer. No other salmon producing country has copied the Norwegian system of special purpose licenses, leaving these functions largely to the market (Young et al., 2019; Chavez et al., 2019; Murray and Munroe, 2018).

Whether the latest Norwegian innovation, the development licenses, represents success or failure remains to be seen. The most important lesson so far, is that such special license arrangements have to pay attention not only to perverse incentives (such as cheap tickets to increased production), but also to the effects on the ordinary management system. If the ultimate goal is sustainable growth, there is limited room for special arrangements with alternative objectives and other rules. In the end, the success of any governance scheme rests on legitimacy, that is, on being respected by most, if not by all stakeholders. Hence, special license arrangements must be *limited*, *closely circumscribed*, and *controlled*; if not they are just undermining the ordinary regulatory system.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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