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Original Article

A realist evaluation of the individual transferable quota system used in Finnish herring fisheries

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Rights-based management, such as the individual transferable quota (ITQ) system, is a popular approach for pursuing economic, social, and environmental sustainability in fisheries, with a variety of outcomes. This variety appears to be explained by the contextual differences between the targeted fisheries. By acknowledging that each fishery is unique, we need to apply holistic evaluation methods to understand the mechanisms causing different outcomes in fisheries interventions. Here, we apply the realist evaluation (RE) approach to evaluate the ITQ system implemented in the Finnish herring fishery. This study serves two purposes: (1) it outlines the realized outcomes of the Finnish management system in relation to the expected outcomes and (2) it introduces the RE method to the field of fisheries management. Measured in economic terms, the results indicate the new management system to be a success, although the benefits are more prominent for large-scale fishers. The context did not allow small-scale fishers to reap the theorized benefits of the ITQ system, leading to a somewhat more uncertain future for the sector. The RE approach proved to be a useful tool, well-suited to the evaluation of fisheries management systems.

Keywords: Baltic Sea, context-mechanism-outcome, fisheries management, ITQ, large-scale fisheries, program theory, small-scale fisheries, sustainability, TFC.

Introduction

Considering the importance of fish as a source of food in a future where the global population is rising, it is vital to find environmentally, economically, and socially sustainable management solutions for fisheries. There have been several suggestions for how to do this, and among them, rights-based management (RBM) is a popular approach (Cunningham, 2005). The core of RBM is the motivation of fishers towards more sustainable operations by creating occupational exclusiveness without privatizing the resource stock (Grafton *et al.*, 2006). One prominent RBM approach is the individual transferable quota (ITQ) system, which utilizes economic incentives in an effort to achieve sustainable fisheries (Arnason, 2009). Quotas are considered as a commodity that gives the owner the right to fish a certain proportion of the total allowable catch (TAC) for a certain species, thus eliminating the "race to fish" and enhancing economic performance (Birkenbach *et al.*, 2017; Anderson *et al.*, 2019). Following the general recommendations of the EU Common

Fisheries Policy (CFP; The European Parliament and the Council, Regulation (EU) No 1380/2013, 2013) and to overcome the declining economic efficiency (Guillen *et al.*, 2018) of the fishing sector, Finland introduced an ITQ system in 2017 for the management of commercial herring, sprat, and salmon fisheries. The quota system officially goes under the concept of transferable fishing concessions (TFC), as proposed by the European Commission, where quotas are revocable user rights rather than infinite property rights.

ITQs have been implemented in various fisheries worldwide, and although common outcomes can be identified, a variety of outcomes exists that appear to depend on the contextual variation. To understand the causal mechanisms behind the nuances in intervention outcomes, we need to apply ex-post evaluation methods that integrate the ecological, social, economic, and governance dimensions of sustainability and combine them with the local-specific contexts. In the field of impact assessment (IA), with its tendency for single impact evaluations, recent developments are redefining the concept towards a more integrated approach, referred to as sustainability impact assessment (SIA; Kumar *et al.*, 2020). By integrating the main pillars of sustainability, SIA assesses policy alternatives, attempting to evaluate the possible outcomes and recognizing the short- and long-term impacts on sustainability. Malvarosa *et al.* (2019) provide a useful guide on how to conduct SIAs in the context of fisheries management interventions. The SIA approach can provide policy makers valuable information regarding policy options. However, SIAs are advocated as an ex-ante approach rather than a tool for ex-post evaluations.

A key factor for the success of any management intervention is evaluation of the outcomes and subsequent system improvements. For this purpose, we apply the realist evaluation (RE) approach (Pawson and Tilley, 1997a). RE offers a structured tool for ex-post evaluations of complex policy systems. It is a theory-driven approach that, like SIA, advocates the use of multiple data collection methods and emphasizes stakeholder involvement. RE attempts to refine the initial programme theory by identifying whether and how an intervention worked in a certain setting. Herein lies the advantage of the RE method, as RE does not simply answer whether a programme works or not, but offers insights into "what worked for whom in what circumstances and in what respects, and how?" (Pawson and Tilley, 1997a). RE has gained momentum, especially within the health field (Byng *et al.*, 2005; Marchal *et al.*, 2010), but is yet to be utilized in natural resource management and policy planning.

This paper focuses on the Finnish herring fishery, as it is the most important fishery in Finland, measured both in tons (92000 tons in 2020) and value. Sprat is the second most caught species (13000 tons in 2020). Although this study focused on herring, both herring and sprat catches are highly concentrated among the same small number of fishers. The salmon fishery was excluded because the background and issues linked to this fishery strongly differs from the herring and sprat fisheries, and it was considered more fitting as its own research topic. Unlike many other fisheries implementing a quota system primarily to restore overfished fish stocks, the Finnish herring stock biomass remained fairly stable from 2014 to 2021, except that the estimate for 2019 was the lowest since 1980 (ICES, 2021). As such, there is no reason to believe that the implementation of the ITQ system was a managerial response to the state of the stock.

Here, we use the RE approach to evaluate the Finnish ITQ system, explaining both the desired and less-desired outcomes of the intervention. For data collection, we conducted stakeholder interviews and reviewed fisheries data gathered by the Finnish Natural Resources Institute. In addition, we used the study of Kulmala *et al.* (2007) to better understand the views of Finnish stakeholders regarding ITQs prior to the system's implementation. By conducting this study at this relatively early stage of the new management era in Finland, our aims are to:

1. Evaluate the early stages of the Finnish ITQ system;
2. Identify stakeholder opinions and concerns, as well as recognize management areas in need of further attention in the future; and
3. Present the RE method and test its usability in the field of fisheries management.

The herring fishery and its management in Finland

The Finnish herring fishery can be divided into (1) pelagic and deep midwater trawling in state-owned waters and (2) coastal trap-net fishing near spawning areas, which mostly takes place during spring in privately owned waters. Coastal trap-net fishing only accounts for a small portion of the total herring catch, while the bulk, some 96% of the total catch in 2017 (Jounela *et al.*, 2018), is caught by the trawler fleet. The catch has been concentrated among a small number of vessels, of which a large proportion have recently been transferred to foreign owners (Natural Resource Institute, LUKE, 2019). An increasing number of landings take place in foreign ports, mainly in Estonia, Denmark, and Sweden (some 20% of the herring catch in 2020). Despite herring being one of the key commercial catch species in the Baltic Sea, in Finland only a fraction of the catch is sold for human consumption, while the bulk is used as fodder for the fur industry and processed into fish oil and fishmeal (Ignatius and Haapasaari, 2016; Pihlajamäki *et al.*, 2018). The number of workers within Finnish fisheries has steadily decreased since the beginning of the 20th century. It is estimated that in 1901, the number of commercial fishers was at least 20000 (Salmi, 2009a), whereas in 2016 there were 1970 registered active commercial fishers (Luonnonvarakeskus, 2021). The majority of these fishers are employed part-time within the small-scale coastal fishery fleet, operating with seasonal boundaries (Guillen *et al.*, 2018). Although the importance of fishing for the national economy of Finland has diminished, it is still of relevance at the regional level (Virtanen *et al.*, 2001). Moreover, commercial fishing has socio-cultural value (Salmi, 2009b; Ignatius *et al.*, 2019).

Finland joining the EU in 1995 meant stricter regulation and control of the fisheries through the implementation of the EUs CFP (Salmi, 2012). The CFP implies that the TAC limits are decided at the EU level, while each member state is responsible for the division of the national quota and fishing rights (The European Parliament and the Council, Regulation (EU) No 1380/2013, 2013). In Finland, prior to the ITQ system, the national quota for herring and sprat was available for all registered commercial fishers. This system promoted competition between fishers aiming to catch as much as possible before the quota limit was reached, a situation often referred to as the "race to fish" or "Olympic fishing." This frequently forced fisheries managers to halt trawl fishing midseason, only to be reopened during autumn (Maa- ja metsätalousministeriö, 2001, 2002). This was done primarily for two purposes: first, to ensure a part of the quota for small-scale coastal fisheries (mainly trap-net fishing focusing on spawning fish in early summer), and second, to ensure that part of the quota was left for the winter season. This management system was considered by many stakeholders inadequate for achieving economic, social, and environmental sus-

tainability (Kulmala *et al.*, 2007), and Finnish fishers wished for a higher degree of influence over management (Ignatius *et al.*, 2019). With the overall revenues in decline, a shift towards a quota-based management system had long been discussed prior to the actual implementation.

Finnish coastal fishers (mainly trap-net fishing) have recently struggled with the growing populations of seals and black cormorants. Seals, in particular, are considered to cause economic losses by destroying fishing equipment (Hansson *et al.*, 2018; Svels *et al.*, 2019). Both seals and black cormorants also feed on herring, although to what extent this impacts on the fishers' catch is debated. High emissions of persistent organic pollutants (POPs) around the Baltic Sea in the 1960s and 1970s, and a subsequently high content of POPs, such as dioxins, in fatty fish species, led to restrictions within the EU regarding the marketing of herring for human consumption (Commission Regulation (EU) No 1259/2011, 2011). Although, recent studies have shown a reduction in both dioxin levels (Rantakokko *et al.*, 2019) and the risks of dioxins in Baltic fish to human health (Tuomisto *et al.*, 2020), these restrictions may have weakened the reputation of Baltic herring among consumers and affected their marketability (Assmuth and Jalonen, 2006; Pihlajamäki *et al.*, 2018; Ignatius *et al.*, 2019). Furthermore, in 2014, for political reasons, Russia implemented restrictions on the country's import of fish products, thereby removing an important export market for Finnish fishers. In an effort to increase the human consumption of herring, it is nowadays being advertised both for its health benefits and as an effective method for removing nutrients from the Baltic Sea.

ITQs and the Finnish system

In the ITQ system, owning a quota represents the right to fish a proportion of a certain fish species/population, thus not privatizing the fish stock itself, which remains a common resource (Kronbak *et al.*, 2014). Quotas, which are shares of the national TAC, are allocated to fishers, who can then use their rights to fish, lease the quota, or sell their user-rights (Grainger and Costello, 2011). This allows fishers to optimize their level of input in order to maximize their output, leading to both allocative and technical efficiency (Grafton *et al.*, 2000). Here, economists emphasize the importance of creating secure, durable, and tradeable ownership rights, with a long-enough-time perspective (Havice, 2013). As such, the ITQ system guarantees the quota holder a share of future catches, allowing the whole fleet to make rational economic decisions, which optimizes the individual economic yield and reduces fleet overcapacity (Beddington *et al.*, 2007). With ITQs, fishers are financially rewarded for the productivity of well-managed and sustainably fished stocks, and the incentive for overfishing and breaching quota limits is hence removed (Emery *et al.*, 2012). Since its first application in New Zealand (Batstone and Sharp, 1999), the ITQ system has gained increasing acceptance and experienced a fair degree of success (Cunningham, 2005; Grafton *et al.*, 2006; Beddington *et al.*, 2007). However, it has also faced criticism, predominantly regarding, but not limited to, the social aspects (Copes, 1996; Copes and Charles, 2004; Olson, 2011), e.g. extensive quota concentration and price developments, making the industry skewed and exclusive.

In 2017, Finland introduced an ITQ system in the herring, sprat, and salmon fisheries. In the planning phase, the programme designers sought practical experiences from other countries, such as Iceland, Sweden, and Denmark. Representatives from these countries were invited to share their experiences of the system. According to the designers, this resulted in a programme consisting of "a collection of the best properties from ITQ systems abroad" (M. Hanstén, pers. comm.), designed to meet the requirements of the Finnish fishery industry. In Finland (excluding the Åland islands), fishers are under the jurisdiction of the Ministry of Agriculture and Forestry, which is responsible for ITQ system design as well as the implementation and allocation of quotas.

According to the designers of the Finnish quota system, the main objective of the system was to improve the economic efficiency of the fishing industry. The social and environmental aspects were also regarded as important, but these were not separately mentioned in the planning process. The designers believed that social and environmental benefits would be achieved in line with the ITQ theory (Grafton, 1996). The Finnish ITQ system covers three species: Baltic herring, sprat, and salmon. From here on, we will focus on herring ITQs. The quota sizes were determined and allocated according to the catch history, where the three best years of a 5-year period were taken into account. Once granted an ITQ, the fisher is obliged to utilize the quota received or risk losing it, in which case the ITQ will fall back to the state to be reallocated. As a globally novel attribute for ITQ systems, Finland introduced a system where 4% of the initial TAC was allocated to new actors (FINLEX 1048/2016, 2016). These "newcomer" quotas were distributed to lure new actors into the industry, thus reducing the exclusiveness and closedness of the system. These quotas were allocated for a 5-year period for persons without a catch history, during which time the fisher could acquire transferable rights from the market.

The law clearly stipulates that the quotas are considered as user rights and that the resource is still owned by the Finnish state (FINLEX 1048/2016, 2016). The difference between property rights and user rights can also affect the quota holders' perceived security of the system, since in user rights nothing is owned and the future is somewhat insecure in this respect (Grainger and Costello, 2011). The user rights were initially distributed for a period of 10 years, with the possibility of prolonging it by a period of 5 years at a time. The rights will be re-evaluated every 5 years so that the fishers will always have a 5- to 10-year time perspective (FINLEX 1048/2016, 2016). This was decided in an effort to "hinder the quota prices from skyrocketing" (quote from personal discussions).

In Finland, herring quotas were divided between the pelagic and deep mid-water trawling fishery and the coastal trap-net fishery (FINLEX 1048/2016, 2016). Coastal trap-net fishing mainly takes place in private water areas, owned or leased by the fisher. Privately owned waters, a relic from political decisions taken in 1766 when Finland was part of Sweden, are a globally rare feature within marine fisheries management (Salmi and Varjopuro, 2001). The two sectors were separated in an effort to protect small-scale coastal fisheries (quote from personal discussions). It is, thus not possible for a trap-net fishing company to transfer their quota rights to a trawl fishing company. The annual quota can, however, be transferred, for instance if the coastal fisher still has quotas left after the trap-net fishing season has ended (FINLEX 1048/2016, 2016). To prevent extensive quota concentration, the law also restricts a single actor from holding more than 20% of the national quota for herring and sprat, a rule applied for both the large- and small-scale sectors (FINLEX 1048/2016, 2016). In 2018, the Finnish fishery law was complemented with two clauses according to the EU's CFP Articles 15.8 and 15.9 (The European Parliament and the Council, Regulation (EU) No 1380/2013, 2013). At the individual level, Article 15.8 allows up to 9% of the bycatch to be registered as the target species, which in practice allows herring fishers in Finland to register sprat

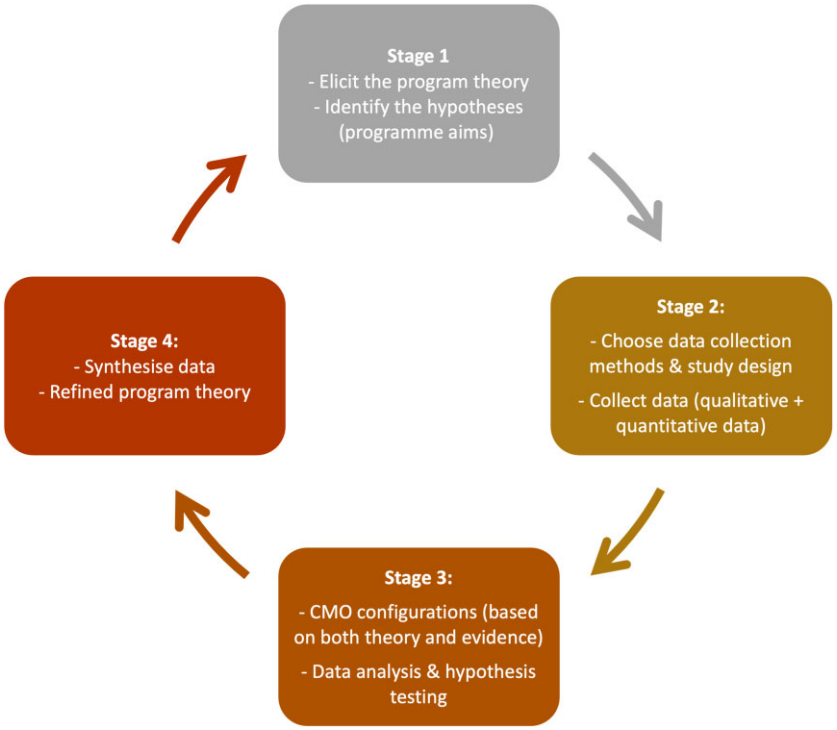

Figure 1. The RE framework.

caught as bycatch as part of their individual herring quota. At the national level, Article 15.9 allows the possibility to overfish the national quota by a maximum of 10%, given that the same proportion is deducted from the quota for the following year. This is seen as a way to stabilize fluctuations between yearly quotas, thus enhancing the operating conditions for the fisheries.

Theoretical framework: RE

RE is a theory-driven evaluation approach that attempts to answer the question "What works for whom in what circumstances and in what respect, and how?" (Pawson and Tilley, 1997a). The RE process attempts to evaluate an intervention based on the context, mechanism, and outcome configurations (CMOc), or C + M = O. In the RE approach, an intervention is considered a theory, which is a product of its creators' imagination of how the programme creates change, i.e. outcomes or a pattern of outcomes (O). However, the fate of a programme ultimately depends on the perception of its practitioners and participants. The mechanisms (M) do not therefore describe the components of a programme, but rather how the subjects choose to interpret and act upon the given resources. These mechanisms also operate in certain conditions or contexts (C), which may or may not allow changes to occur (Pawson and Tilley, 1997b; Salter and Kothari, 2014).

Programmes are always implemented in pre-existing social contexts with their own rules, norms, and values, which are all crucial in explaining the myriad of outcomes or outcome patterns following the implementation (Pawson and Tilley, 1997b). The RE approach sees both the material and social world as "real", i.e. anything that produces real effects is by definition real, but the perceived reality is always influenced by the human brain and "final knowledge" cannot therefore exist (Westhorp, 2014). However, the RE approach believes the real world to produce boundaries for what is reasonable to believe, and as such, over time, knowledge can be improved (Westhorp *et al.*, 2011). As RE does not ask one single question, it consequently does not rely on one single outcome. In fact, RE starts with a theory and ends with a refined theory (Pawson and Tilley, 1997a), contributing to an ongoing theoretical development. In this sense, the evaluation never answers the question of whether an intervention works or not but will give decision-makers a better understanding of what worked for whom in what circumstances.

Methods

For the purpose of this paper, and based on the RE theory (Pawson and Tilley, 1997a), Figure 1 presents the four-step framework used in our evaluation process. Each step is described below.

The first stage of RE is involved in identifying the initial programme theory. This was done in two steps. First, by using Google Scholar to find relevant articles, we reviewed a number of ITQ implementation cases around the world. This was done to gain an understanding of the challenges associated with the introduction of the ITQ system, to identify possible outcome patterns, and to contemplate on the possible effects in the Finnish context. Second, the first author co-conducted two interviews with the two developers of the Finnish ITQ system, clarifying the implementation process and the expected outcomes of the programme. Based on this, we elicited the initial programme theory.

In the second stage, we conducted stakeholder interviews to identify the mechanisms and to understand the context wherein they operate (Manzano, 2016). A total of 15 stakeholders were interviewed during the autumn of 2018, including managers (1), researchers (1), representatives of fishermen's unions (3), other non-profit organizations (2), fish processors (2), commercial trawl (3), and trap-net (3) fishers. All the groups were analysed separately.

Table 1. Initial programme theory: key elements and hypothesized outcomes.

Elements	**Impact**	**Hypothesized outcome**
Individual quotas (user rights)	Secure catch proportions. Increases efficiency.	Economically more stable companies. Increased profitability.
Quota and user right transfers (quota market)	Optimization of quota distribution. The market assigns a monetary value to quotas and user rights—incentive to exit the industry.	Increased flexibility. Reduced fleet size (aimed predominantly at the trawl fleet).
Newcomer quota	Reduces exclusivity. Easy access for new actors.	Lures new actors into the industry (mainly to the small-scale sector).
Separate small- & large-scale user rights	Hinders the concentration of user rights in large trawl companies.	Secures the continuation of the small-scale sector. Allows both sectors to thrive.
Social & environmental factors	Better operational environment. Removes incentive to overfish.	More secure employment and safer working conditions. Sustainable fishing.

However, in the quotes provided in the result section, we grouped the representatives of the fishermen's unions, non-profit organizations, and fish processors into "Interest group" to ensure that the identities of the interviewees representing small stakeholder groups will not be revealed. Stakeholders were selected based on their role and interests in the Finnish herring and sprat fisheries. As the fishery scene in Finland is rather small, the 15 interviewees represented a large proportion of those who know the ITQ system well. For instance, only two managers planned the whole ITQ system and, since their opinions and views appeared very similar in the initial discussions, we interviewed only one of them. Similarly, as our main focus was on the stakeholders' perceptions of the outcomes of ITQ, we interviewed only one researcher. The perspective of the researcher was, however, considered important in comparing opinions of the implementation process and expected outcomes. No representatives of environmental NGOs, with knowledge about the Finnish ITQ system, were available for this study. However, we did not consider this a problem, as in Finland the herring stocks are considered to be fished at a sustainable level. The interviewed fishers represented different coastal areas of Finland. The semi-structured interviews consisted of 17 questions regarding the Finnish ITQ system, as well as the prospects for the industry. All interviews were audio-recorded and transcribed. The transcripts were entered into Atlas.ti and coded using a thematic analysis approach (Miles and Huberman, 1994; Boyatzis, 1998; Friese, 2019). In addition to the interviews, data related to the implementation and outcomes of the ITQ system were retrieved from the open data source of the Finnish Natural Resources Institutes (LUKE).

In stage three, we analysed the collected data through three main steps:

1. Based on the initial program theory, we categorized the data by identifying significant elements of ITQs, the actors, or stakeholder groups, as well as the context, mechanisms, and outcomes.
2. In the subsequent rounds of the analysis, the themes and patterns were refined, identifying various outcome patterns. This resulted in a total of five groups of outcomes: (1) individual quotas (user rights), (2) quota and user right transfers (quota market), (3) newcomer quotas, (4) separate small- and large-scale user rights, and (5) social and environmental factors
3. In the final step, the mechanisms and contextual factors were further analysed in relation to the outcomes. The resulting CMO configurations determine the most plausible explanations for the recognized patterns of outcomes, i.e. explaining in this context, this mechanism was triggered by these actors, generating these outcomes.

In the fourth stage of the RE, the CMO configurations were synthesized, offering plausible explanations for the actual outcomes (refined theory) in comparison with the assumed outcomes (initial program theory). It is not in the nature of RE to present universal truths and recommendations regarding programme theories. Instead, RE offers insights for decision-makers into how the updated theory may help to tune the system in the desired direction.

Results

Based on the programme theory, Table 1 presents the key elements of the system as well as their hypothesized outcomes.

Context-mechanisms-outcomes

Based on the programme theory and the hypothesized outcomes, we here present five different CMO configurations:

1. Individual quotas (user rights)
2. Quota and user right transfers (quota market)
3. Newcomer quotas
4. Separate small- and large-scale user rights
5. Social and environmental factors

1. Individual quotas (user rights)

Context

The atmosphere of the Finnish fishing sector favoured the implementation of the ITQ system. Many fishers wished for the system to be implemented, and some of them had experience of ITQs from abroad. The industry was economically in a downfall and in need of modernization, at least on the management side. The race-to-fish phenomenon was considered to trigger a negative spiral in the industry. Trawlers and trap-net fishers who operated in different environments, however, perceived the ITQ system and its acceptability differently.

Mechanisms

Most of the interviewed stakeholders were of the opinion that ITQs are the right management system for Finnish fisheries. Those opposing the system were fishers targeting herring mainly for human

consumption. A common perception among trap-net fishers was that they should have been left outside the individual quota system. Instead, trap-net fishers felt they should have been allocated their own share of the national quota, which would have been open to all registered small-scale fishers. A couple of reasons were mentioned: first, ITQs were considered to hinder up-scaling, since there is often a lack of financing possibilities to buy more quotas, and second, small-scale fishers are more vulnerable to reductions in the TAC, also reducing the number of high-quality fish caught for the human consumption market. The managers had considered that including small-scale fishers in the system would secure the continuation of small-scale coastal fisheries, e.g. fishers targeting herring for human consumption. Most stakeholders agreed that by separating the quotas for trawl and trap-net fisheries, and controlling the transferability between them, the continuity of small-scale fisheries had successfully been secured.

A general assumption among the interviewees was that the quota system will have a positive economic effect on individual fishing enterprises and the industry as a whole. Some of the positive factors mentioned were improved flexibility, cost-efficiency, and improved planning and cooperation possibilities. However, some stakeholders pointed out that the global market prices for fodder, the development of the Finnish fur industry, and the recent loss of the Russian market also affected the economic performance of fisheries. The interviewed fishers targeting fish for human consumption considered the quotas to have a negative impact on their economy:

> *"Now I never know if I can rent [quotas] from someone or where the quotas are going… so it [Finnish national quota] might go up in 2020, what if I buy quotas now, then I will have too much, and then the state will take it back if I cannot fish it"—Commercial fisher*

One stakeholder brought up the issues linked with the private waters and ITQ:

> *"…a clear limiting factor [the quotas] … I have bought my own equipment, my own water areas and I am doing everything myself, then suddenly this sets a limit for how much I can fish…"—Commercial fisher*

Due to the extensive race to fish, herring trawling has previously been concentrated at the beginning of the year, whereas ITQ allows fishers to decide whether to save catches for later in the year. During summer, warmer weather makes catching and storing fish more labourious, yet some interviewees considered that an increase in demand and higher fish prices would enable the technical developments required for extending the fishing of herring for human consumption to the summer months. The concentration of quotas in larger actors was considered as a sign that the system is working properly, and was by no one mentioned to induce negative social consequences. However, quota concentration had long occurred prior to the implementation of ITQs, and as such, this development, and possible negative consequences, was difficult to blame on the system *per se*. The reduced race to fish was appreciated among all stakeholders, highlighting the possibility for long-term planning and increased flexibility. Generally, attitude towards the future of the industry had slightly improved along with the new system and signs of increased cooperation could be seen. The trap-net fishers had not noticed any significant quota concentration within their community. Some fishers had given up because they had not been given enough quotas and some retired due to a high age, and thus received welcomed "retirement money" when selling their quota rights.

A general perception was that the number of fishers will continue to reduce as a consequence of the high average age among fishers, the requirement to modernize the fleet and processing facilities, as well as owing to the lack of political will to support fisheries. The quota system was not believed to have any major impact on this development. It was assumed that the trawling sector will further concentrate into larger and more profitable companies. Views of the future for small-scale fisheries varied. Some saw a positive development for fishers targeting quality fish: by forming larger units and developing their own market segment, combined with an increasing demand for fish products for human consumption, they would secure their future.

> *"…there will most likely be three or four larger trap-net companies in this area, who will own a larger share of the quotas and utilize seasonal workers"—Interest group*

Others considered the high average age among fishers, combined with the low price for herring, and the problems faced due to the seal and black cormorant populations, as obstacles to the continuation of the small-scale sector.

Outcomes

- The herring catch has been more evenly distributed along the season compared to the earlier system (Salmi *et al.*, 2019).
- Stakeholders believed profits will rise. Short-term data supports this (Kärnä *et al.*, 2020), but only time will reveal the accuracy of this belief.
- Some small-scale fishers expressed their concerns regarding the individual quotas limiting their operation owing to unfairness in both the quota distribution method and the system favouring large-scale fishing.
- No marked changes in the fish price have been recorded at this early stage (Salmi *et al.*, 2019).
- The quota prices have remained at an "acceptable" level.

2. Quota and user right transfers (quota market)

The Finnish fleet for herring and sprat fisheries was considered too large in relation to the catch to achieve (economic) sustainability. This did not necessarily apply to the small-scale fishery sector, where the average age of active fishers is considered high and newcomers are few. Making the user rights and quotas transferable *via* a quota market was seen as a necessity by the managers, as well as by the majority of the stakeholders, as it would allow businesses to grow and offer monetary compensation to those choosing to sell their user rights, i.e. leave the fishery. There was, however, already a negative trend in the number of registered fishers prior to the implementation of the new system, and as such, opinions varied as to what extent ITQs will support this trend.

Mechanisms

Most stakeholders considered the transferability of quotas as an important property of the system. The option of transferring user rights or renting quotas allows for better business planning and allows actors to make rational decisions to enhance their economic performance. Concerns existed that more and more quotas are being transferred to foreign owners. However, this development was already visible before the introduction of the quota system. Risks associated with buying more quotas were considered low, although drastic changes in the TAC limit were acknowledged to impact on

the stability. However, some concerns were noted among trap-net fishers, given that the seal and black cormorant populations will continue to increase. If this development hinders the fishers from fishing, investments in new quotas would be in vain.

A common online market channel for selling and buying quotas would, according to some actors, be a welcomed supplement, while others saw no need for one, as the fisher community is small and the current system of personally contacting each other was considered sufficient. Regarding the law limiting one actor from possessing more than 20% of the national quotas, the common perception was that it is good to have a limit. However, this limit was considered easily circumvented through strategic business planning.

> *"…it is possible to evade through strategic company structures, in which case it does not matter what the percentage is."—Interest group*

Outcomes

- Most stakeholders had witnessed fishers leaving the occupation after the implementation of the ITQ system, either due to retirement or because of not having enough quotas. Preliminary fisheries data supports this development (Salmi *et al.*, 2019).
- Quota renting was appreciated among all stakeholders and, compared to user right transfers, was more actively utilized (Salmi *et al.*, 2019).
- The system of "calling your fellow fishers" for quota trading may weaken the flexibility and fairness of the programme. An official quota trading platform was called for. This would also enable the tracking of quota price developments.

3. Newcomer quotas

Context

The number of fishers, especially in the coastal small-scale fisheries, has for a long time been in decline. A general perception among the interviewed stakeholders was that the poor economic prospects and large initial investments make it a difficult industry to enter. On top of this, it was considered that the lifestyle of a fisher is not appealing to the younger generations. Newcomer quotas were presented as a solution to this problem. With the implementation of a new system that enhances the economic prospects of the industry, and simultaneously keeps the door open for new fishers, managers hoped to lure more actors into the industry.

Mechanisms

However, most of the interviewees considered the possibilities for newcomers to enter the fishing industry as weak, pointing out that the industry is not a profitable business to enter if starting from scratch. It was considered too big of an investment for newcomers to buy a vessel and all the equipment, and with the new system in place, the eventual buying of quotas (after the "newcomer period" ends) was now considered a further investment needed when entering the industry. This suggests that the intended mechanisms did not trigger due to the contextual factors. Stakeholders also mentioned a number of cases where existing fishers had applied for newcomer quotas, e.g. by registering a family member as a "new" fisher. This is a case of an unintended mechanism triggered by the new system. A couple of stakeholders criticized the newcomer quotas for only further reducing the existing fishers' share of the TAC and pointing out that the share allocated to newcomers actually ended up being utilized by existing fishers "*playing the system*."

Outcomes

- A total of 27 newcomers were registered in 2018 (Salmi *et al.*, 2019). Some of these may have been existing fishers who registered a family member as a new fisher.
- Luring newcomers into the industry did not work as anticipated.

4. Separate small- and large-scale user rights

Context

The interest in protecting small-scale coastal fisheries is naturally advocated by the sector itself, but it is also prominent in the CFP. The Finnish small-scale herring fishery is both socio-culturally and economically important at the local and regional levels, although its economic impact on a national scale is quite low compared to large-scale fisheries. The different nature of the small-scale and large-scale fishery sectors in Finland advocated the separation and control of transferability between them. To avoid a situation where all user rights are held by large-scale fishers, i.e. trawlers, managers decided that the two sectors will have separate non-transferable user rights. Although the separation is considered important, different views exist in the industry regarding whether the small-scale sector actually wished for an individual quota system and to what extent the sector was included in the planning of the new management system.

Mechanisms

The majority of the interviewees did not find any notable differences in the way the system treats large and small, or trawl and trap-net, fishing companies. Comments were given that all follow the same rules and laws, and thus have the same prerequisites for succeeding. However, some concerns were expressed regarding trap-net fishers not having the same opportunities to sell their quotas or user rights, since active trap-net fishers are decreasing in number and the capital for investing is often limited in smaller fishing companies. Transferability is an important property of the ITQ system, and as such, the lack of quota transfer possibilities hinders the expected optimization of the fishery fleet. Some of the trap-net fishers noted that the inequality occurred prior to the allocation, rather than now when the system is up and running. This statement refers to the fact that most interviewees had either experienced or heard of instances where trawlers were maximizing their catch history prior to the implementation.

> *"The fishing did not make any economic sense at times… they were only fishing to maximize their catch history"—Commercial fisher*

The general perception among trap-net fishers was that they were not properly informed about the ITQ system, or them being a part of the system, and as such were not given an opportunity to affect their catch history in the same way as the trawlers did.

> *"…trap-net fishers did not know how it was planned, trawl fishers knew, and they were able to manipulate their catch history…"—Commercial fisher*

This apparently caused a lot of negative feelings and bitterness among the trap-net fisher community.

The allocation of quotas based on the catch history was seen by most interviewees as the right option, some of them adding that it is not necessarily a perfect system, but the best option available.

> *"…do not believe a system that would be fair for everyone will ever be found… there will always be those who lose and those who win"—Commercial fisher*

The interviewed scientist thought that the quotas should have been divided through an auction, since fish is a natural resource that belongs to everyone. The fishers targeting herring for human consumption (three trap-net and one trawl fisher) were all unsatisfied with the quota allocation process. It was believed that the system favoured large-scale fodder fishers e.g. they had seen how the larger trawlers even fished in an uneconomical manner just to maximize their catch history prior to the implementation. The small-scale fishers, who according to some comments, initially were unaware of being included in the ITQ system, as well as whose catch is limited by the short fishing period, was unable to maximize their catch history in the same manner. One interviewee mentioned the extra cost of now being forced to buy more quotas to be able to fish the same amount as a few years back, acknowledging that the national herring quota was drastically reduced simultaneously with the implementation of the ITQ system, which naturally reduced the quantity of fish the user rights cover.

Outcomes

- The separation of small- and large-scale fisheries, including the limits for transferring user rights between them, is considered a necessary property of the system.
- No agreement exists on the benefits of including small-scale fisheries in the ITQ system.
- Concerns regarding the system's functionality for small-scale fishers are evident.
- The option for coastal fishers to rent their annual quota to trawlers is a positive property of the system.

5. Social and environmental factors

Context

Although economic objectives were regarded as the primary objective of the ITQ system, social and environmental objectives were also acknowledged. The TAC decisions taken on the EU level were considered to ensure the sustainability of the fish stocks. Occupational safety aspects were believed to have been directly improved through the ITQ system by allowing fishers to stay in port during dangerous weather conditions, a decision not lightly taken in a race-to-fish situation. Other social aspects were linked to the low profitability of the industry and the unpredictable top-down management. By limiting user rights to a definitive time period, managers tried to reach a balance between controlling quota price escalation and allowing a long-enough-time horizon for businesses to function.

Mechanisms

Limiting user rights to a period of 10+5 years was mostly viewed as positive and a sufficient time span for business planning within fishing companies. The new system was considered to create a secure environment for businesses to operate. The fishers were concerned about whether the ITQ system will continue after this time period. Although the option of not continuing was seen as unlikely, confirmation of its continuity was wished for.

> *"If you apply an individual quota system, do it properly, why this in-between model?"—Interest group*

Equally, investments were also associated with the uncertainty of the system's future.

> *"If I invest money now in new quotas, what will happen after ten years, will all the money be wasted?"—Commercial fisher*

Some interviewees agreed with the positive impacts of ITQ on fishers' work safety, at least in theory, while others were not convinced that any changes would be seen in practice. However, not being forced to fish during the worst storms in fear of losing part of the national quota, as well as the reduced stress caused by the previous race-to-fish situation, was appreciated.

None of the interviewees considered the ITQ system to have an impact on the sustainability of the fish stocks, since the TAC is still decided on the basis of the same scientific evidence as before. Some fishers expressed their disbelief in the stock assessments, as they considered the stocks to be larger than what the scientific evidence claims. Some also commented that during years with good catches, the market is the factor limiting fishing, since both demand and the processing capacity are insufficient.

Most interviewees agreed that it is best to have separate quotas for the herring and sprat fisheries. The benefits of combining them were seen in the main basin of the Baltic Sea, where the sprat quota is often considered as a limiting factor when catching herring. One participant commented on the recent introduction of a clause allowing up to 9% of sprat caught as bycatch to be registered as herring:

> "to have different quotas has lost its meaning… Also allowing those who had not previously fished sprat to start to do so… This was introduced after the initial quota allocation, messing things up a bit"—Commercial fisher

Similarly, a couple of stakeholders stated that they were happy with the introduction of ITQs, but that the managers should fully commit to the system, stop intervening, and allow the system to adjust according to the markets, as it is supposed to do. This indicates that constant changes in the system are partly perceived to alter the stability of the industry, i.e. the stability for a company to operate. A number of fishers mentioned an increase in surveillance when it comes to controlling possible overfishing, an attribute considered partly positive and partly to have increased the amount of "paperwork" fishers need to spend time on.

The interviewees were sceptical about the idea of quota saving, or bankable ITQs, as a method to fully or partly save quotas in return for an interest rate based on fish growth and stock reproduction. Most of them considered that a possibility for "quota saving" would be a welcomed addition, but not for the intended purpose. None considered the biological factors behind such a system as a strong argument, but instead saw the advantages of it in improved flexibility and business planning. For instance, in the case of a vessel breakdown, the quotas could be saved for the next season. Some of the stakeholders immediately dismissed such a system since, in practice, it would not be possible to be combined with the current system.

Outcome

- Reduced stress levels, safer fishing conditions, and the sense of being able to manage one's own business are the positive outcomes of the ITQ system.
- The ITQ system is believed to create a better environment for businesses to succeed.
- ITQs were not seen to have an impact on the sustainability of fish stocks.

Refined theory

Based on the analysis of the collected data and the best available knowledge, we here present an updated view of the Finnish ITQ system. The primary aim of the ITQ system in Finland is to improve the economic prospects of the fishing industry. However, the system treats the large- and small-scale fisheries differently.

The ITQ system works as expected in the large-scale fisheries. It has enabled a possibility for an increase in the economic performance of this sector. ITQs allow fishing according to demand and a prolonged fishing season. Thus, the system provides flexibility for fishers in operational and long-term planning. Quota trading provides a possibility for the fishers to increase their catches. As a market-based system, the ITQ favours larger and more efficient actors, which may imply that the user rights concentrate to fewer actors.

The ITQ system may not reach its full potential in the small-scale fisheries sector. On the contrary, it may reduce the viability of this sector. Small-scale fishers often lack the financial resources to acquire further quotas, which decreases their possibilities to increase business. This may lead to imbalance in quota trading between small- and large-scale fishers. ITQ is not a solution to the problem of the ageing of the fisher community. Although the Finnish ITQ system, in theory, allows newcomers to enter the system and replace retired fishers, this is difficult in practice owing to the high investments needed. The costs to the small-scale fisheries caused by seals and black cormorants further worsen their economic situation.

In general, the ITQ system enables an even distribution of catches over the season. It allows fishers to better control their own businesses, which reduces their stress levels. The system can even improve occupational safety aspects, as it allows fishers to stay in port during dangerous weather conditions. Both quota renting and user right transfers have shown its benefits. For the transactions, an official quota trading platform could be useful. It would also allow tracking of the development of quota prices. Enhancing the profitability of larger fishing companies and removing the less efficient actors is a key element of the ITQ system. This will further reduce the number of fishers in Finland. The fairness of the system can be questioned from the perspective of small-scale fishers and the viability of coastal communities.

Discussion

To what extent the new management system has been a success largely depends on the perspective. The primary objective of implementing the quota system in the Finnish herring and sprat fisheries was to improve the economic efficiency of the industry. From this perspective, the ITQ system could be considered a success in its early stages, particularly within the trawl fishery sector. However, the actual outcomes within the small-scale fishery sector have led to weaker prospects. In the planning phase, Finland utilized both theoretical knowledge and practical experiences from countries utilizing similar management systems. The perceived unfairness of the system's implementation as well as its functionality in the small-scale fishery sector remains one of the largest reasons for dissatisfaction. A fundamental question is whether these less-favourable outcomes of the Finnish quota system are a consequence of inadequate planning or the nature of the ITQ system. By allocating a separate quota for small-scale fishers, Finland managed to circumvent the common critique of ITQs that decreasing fleet overcapitalization is often done at the expense of small-scale fishers (Eythórsson, 2000; Stewart *et al.*, 2006). However, our results indicate that the continuation of the small-scale fishery sector is also dependent on other factors, such as seal population developments and fish product demand, that are not directly linked to the quota system. There are today several institutions and organisations that recognize small-scale fisheries as a separate sector in their guidelines, highlighting their importance for achieving sustainable fisheries (European Commission, 2016; Cohen *et al.*, 2019; FAO, 2019; Said and Chuenpagdee, 2019). Considering this, we believe that future studies should focus on recognizing the causal mechanisms of an individual quota system for small-scale coastal fisheries, as the sector does not necessarily operate under the same mechanisms as the large-scale sector.

In this study, we applied the RE method to evaluate the performance of the ITQ-based management of the herring fishery in Finland. The outcomes of the Finnish quota system have followed a similar pattern as in other Baltic Sea fisheries: reduced fleet capacity and enhanced overall profitability (Blomquist and Waldo, 2018; Bonow, 2018; Merayo *et al.*, 2018). However, common across these fisheries is also the uneven distribution of profitability between small- and large-scale fishers. Nevertheless, it needs to be pointed out that the negative impacts cannot be fully explained by the quota system, but rather are a combination of many contextual factors, as mentioned above. Ultimately, each fishery is unique, with its own contextual properties and causal mechanisms. As earlier case studies indicate (Dewees, 1998; Asche *et al.*, 2014), it takes some years of turbulence before the fishery fleet, and the industry, enters a more stable form after the implementation of the ITQ system. Thus, the long-term economic, social, and environmental outcomes of the Finnish ITQ system are yet to be seen. Long-term results will also allow discussion of the opportunity costs from the decision taken to divide quotas based on catch history, and not through an auction as the interviewed scientist had preferred.

In Finland, trap-net fishers predominantly fish in private waters that they either own by themselves or rent from the water area owner. This means that, in principle, individual quotas limit the right of these fishers to fish in their own or rented waters. These fishers were also subjected to regulations under the previous management form, which restricted the utilization of the national quota mainly through time- and area-based measures. Finnish law stipulates that fish stocks, as a resource, are owned by the state, thus indicating that owning waters is not equivalent to owning the resources in the water. However, fishers are able to restrict other fishers from fishing in their waters. To what extent this "double ownership" was contemplated in the planning phase, and to what extent the ITQ system is affected by it, is an interesting question. For a newcomer entering the small-scale fishing sector, this may imply even more investments if the person is not only forced to buy or lease quotas, but also the right to fish in private waters.

RE offers a comprehensive evaluation process, and much like the *ex-ante* evaluation approach SIA, RE advocates stakeholder involvement as well as utilizing a variety of data collection meth-

ods. Hilborn *et al.* (2020) discuss the importance of understanding "*what methods of management have worked in what social, economic, political, and biological contexts,*" and based on that, how the most appropriate management systems should be implemented. We find the RE tool appropriate for this purpose, as it offers a deeper understanding of the changes brought about by an intervention in relation to the context. RE does not offer the definitive truth regarding whether an intervention worked, but rather offers policymakers an explanation of "what works for whom in what circumstances and in what respect, and how." As an ex-post evaluation tool, it can be used across different sectors in marine and coastal management, identifying causal mechanisms for both single-sector and cross-sectoral cumulative IAs. There are nonetheless some challenges in utilizing this method. First, changes in complex social systems take place at many levels, where people and organizations are all influenced by multiple internal and external pressures. Evaluating these multi-causalities is challenging and one needs to accept that there are rarely any simple explanations. The researcher not only needs to find the casual relationships within the system, but also link them to the initial programme theory. Navigating through this requires stakeholder engagement as well as drawing conclusions from other information sources. Second, CMO configurations are a powerful frame for explaining causal mechanisms, but they also present challenges in recognizing and separating which outcomes of an intervention are theory driven and which are context driven, i.e. to what degree the changes are due to the intervention itself or to the contextual factors triggering changes. Herein, lies the complexity of identifying mechanisms. Third, RE requires considerable expertise on the subject, as well as time and resources. Nonetheless, RE has the potential to provide highly valuable information for policymakers.

Conclusion

- Finland appears to have followed a rather typical direction for fisheries globally where ITQs have been utilized. The system enables efficient and/or financially stable companies to flourish, enhances the profitability of the industry, and reduces the overcapacity of the fishery fleet. Meanwhile, less attractive impacts occur among small-scale coastal fisheries, which affects rural communities and factors broadly perceived as the social inequities of ITQs.
- The Finnish herring and sprat fishery industry will most likely go through a few years of more turbulent changes before reaching a more stable form. In the continuation, a special focus needs to be placed on the small-scale fishery sector, securing its future and profitability.
- RE is an appropriate method for the ex-post evaluation of fisheries management systems. It offers a comprehensive approach that analyses outcomes in relation to the contextual factors, contributing to the development of the initial program theory.

Data availability statement

The data underlying this article cannot be shared publicly in the interest of protecting the privacy of individuals that participated in the study. The data will be shared on reasonable request to the corresponding author.

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