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Food for Thought

Sustainable seafood certifications are inadequate to challenges of ecosystem change

Melina Kourantidou [1]* and Brooks A. Kaiser [1]

[1]*Management and Economics of Resources and Environment Research Group, Department of Sociology, Environmental and Business Economics, University of Southern Denmark, Niels Bohrs Vej 9, Esbjerg 6700, Denmark*

**Corresponding author: tel: +45 65504144; e-mail: mkour@sdu.dk.*

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The recent Marine Stewardship Council certification for the Russian Barents Red King Crab demonstrates the consequences of overlooking ecological factors in seafood sustainability assessments. The crab is commercially valuable but has uncertain invasive effects for the ecosystem. Russian authorities manage it as a long-term fishery and openly accept the co-incidental risks that come along with the invasion. The Russian crab fishery is monopolized and there is limited transparency on both quota acquisition and decision-making regarding its management. Including ecological and socio-political dimensions expands the sustainability definition to more closely match general consumer perceptions of what certified sustainability represents. The focus of widely trusted certification processes on fishery practices masks important sustainability considerations from end consumers and may distort their choices.

Keywords: commercial invasive species, fisheries, red king crab, sustainability certification

Introduction

The recent Marine Stewardship Council (MSC) certification for Russian Barents Red King Crab (RKC), a purposefully introduced invasive species, demonstrates how definitions of sustainability for seafood certification face growing pressures that will make certification increasingly less informative as a measure of sustainable production.

Certification schemes have developed in response to human behaviours including overharvesting, Illegal, Unreported, and Unregulated (IUU) fisheries, and mislabelling of seafood products. Disclosure of harvest practices, tracking of seafood product composition and provenance, and "eco-labelled" seafood products that aim to inform end-consumer choices have evolved into programs like the MSC and Friend of the Sea or rating platforms like Monterey Bay Aquarium Seafood Watch, Ocean Wise or the Marine Conservation Society. These programs focus narrowly on the behaviour and welfare of the fishers and individual fish stocks. Concerns about the reliability of these certification standards usually stem from definitions of overexploited fish stocks or interpretations of overfishing (Froese and Proelss, 2012; Agnew *et al.*, 2013; Holmyard, 2018).

In stable ecosystems, this focus may work sufficiently well to rank choices for sustainability. Disruptions from bio-invasions, temperature changes, ocean acidification and other climate and human impacts are threatening marine ecosystems around the world, including many that support certified fisheries, with growing frequency. A map of MSC fisheries (MSC, 2017) shows that the majority is outside the equatorial range, in northerly or southerly ecosystems where climate change impacts are expected to be more dramatic. Indeed, Arctic waters have already seen significant temperature increases and growing concern about ocean acidification (AMAP, 2018; Ulfsbo *et al.*, 2018), with consequences for primary production and dependent fisheries (Pecl *et al.*, 2017; AMAP, 2018; Feng *et al.*, 2018). The lack of attention to ecosystem concerns limits consumers' ability to apply market pressures for more broadly sustainable practices.

In recent years, an increasing literature has highlighted the limitations of seafood certifications. A growing body of work focuses on MSC certification, which accounts for 12% of the global marine wild catch (MSC, 2017; Brad *et al.*, 2018). Criticism of the MSC standard includes financial conflicts of interest (Jacquet *et al.*, 2010), the accuracy of estimates on health of stocks and fishing pressure (Froese and Proelss, 2012; Bailey *et al.*, 2018), the selection and objectivity of third-party certifiers (Jacquet *et al.*, 2010; Christian *et al.*, 2013), the difficulties and costs in the objection process (Christian *et al.*, 2013), limited representation from the developing world (Jacquet *et al.*, 2010), the positive bias towards large-scale fisheries and the difficulties in certification of small-scale fisheries (Jacquet and Pauly, 2008; Foley and McCay, 2014), and the standard's implications for shifting market dynamics in ways that negatively affect resource access and production relations (Foley, 2012).

Although these criticisms are widely recurrent in the literature, there is limited evidence on the adequacy of seafood sustainability certification processes for addressing ecosystem changes driven by climate and market dynamics. No studies to date have sought to examine how consequences to ecosystems from commercially harvested marine invasive species can be accounted for in sustainability certification assessments. This paper uses the case of the recently certified RKC in the Russian part of the Barents Sea to shift the attention toward this understudied challenge. The case of the RKC is an example of how certifications may fail a basic sustainability test by not sending, receiving, and processing appropriate signals of consequential ecosystem change in a timely manner (Meadows and Randers, 2012). Such failures can be expected to exacerbate the negative consequences of certifications. This is because certification can act to e.g. reduce perceptions of the need to research uncertain ecological impacts as more and more species move into new habitats or face new ecosystem conditions that change fisheries productivity, in the same way that certifications or minimum quality standards may stifle innovation (Maxwell, 1998; McCannon, 2018). Ignoring these risks can easily undermine public trust by damaging the credibility of seafood certification systems and can also thwart the dissemination of conservation science among the public.

The motivation for this analysis follows from the potential that the Russian Barents Sea Red King Crab certification is just the first of many possible efforts to certify fisheries with similar characteristics. There is an increasing number of cases where commercial harvesting of invasive species is used as invasion control mechanism (Parkes, 2006; Gentle and Pople, 2013; St-Hilaire *et al.*, 2016) or as a means of supporting livelihoods (de Neergaard *et al.*, 2005; Mwangi and Swallow, 2005; Pienkowski *et al.*, 2015). These goals raise concerns that come along with such policies, namely that the damages from the invasion will be elided in decision-making, to the detriment of long term ecosystem health and productivity (Nuñez *et al.*, 2012; Kourantidou, 2018). Our approach is therefore applicable more generally and can inform ongoing policy discussions on sustainability definitions for those species with multiple roles.

The Barents RKC fishery

In 2018, the invasive RKC (*Paralithodes camtschaticus*) in the Barents Sea became the first king crab fishery in the world to receive MSC certification as a "sustainable and well-managed fishery." Though scientists recognize potential ecosystem threats, no comments or concerns arose in either the mainstream media or scientific literature to challenge the certification process (Spiridonov, 2018). This lack of public input weakens certification due, at least in part, to the narrowing effects and other impacts of expert bias, which must be actively countered in the certification process (Tversky and Kahneman, 1974; de Little *et al.*, 2018).

To better understand the potential for expert bias in the case of the RKC along with other major flaws in the MSC certification process, we provide background information on the initial introduction of the profitable invasive crab, the evolution of the management and stance of the Russia and Norway as stewards of the shared Barents RKC stock, and the socioecological, economic and political challenges that make fisheries policies controversial and contentious. That helps unfold the three major flaws of the MSC certification for this fishery, which represent interwoven ecological, socio-political, and economic concerns. These flaws are the ecological uncertainties, the lack of transparency in the Russian quota allocation system and the gaps associated with two of the core principles of the MSC standard.

The native distribution range of the RKC lies in the Northern Pacific Ocean and the Bering Sea (Pedersen *et al.*, 2006) with the largest RKC fisheries taking place in Alaska and the Russian Far East. The RKC population in the Barents Sea is a result of an intentional introduction for marine cultivation purposes that took place during the 1960s close to Murmansk (Fig. 1). Today the RKC distribution covers about 12% of the Barents Sea [142,048.9 km^2 in Russian waters, 11,280.86 km^2 in the Norwegian quota area (East of 26°E) and 12,253.320 km^2 in the Norwegian open-access area (West of 26°E) (Fig. 1)]. The main body of the distribution is in the southern part of the Barents Sea, between 25° and 57°E (Pechora Sea), with the highest abundance observed in the eastern part of the Murman Rise and in the Kanin Bank (Zakharov, 2016).

The first attempts to introduce the RKC in the Barents Sea occurred in the 1930s in Murmansk (Orlov and Karpevich, 1965). The introduction failed to establish a population. The transplantation was attempted again, this time successfully, in the 1960s with the introduction of 10 000 juveniles, 2609 adults and ∼1.5 million larvae near the Kolsky Bay (Orlov and Ivanov, 1978) (mainly into Kola Bay and adjacent areas of Western Murman) (McBride *et al.*, 2016).

The introduction project, although approved by the Soviet Union Academy of Sciences (Orlov and Ivanov, 1978), was not shared with the Norwegian authorities, who were neither informed nor asked to consent to the introduction. Norwegians reported first crab in their waters in 1976, when a crab was found in the inner part of Varangerfjord (Kuzmin and Olsen, 1994). The Norwegians delayed any action; meanwhile the crab population continued to grow.

Crab bycatch impacts to other Norwegian fisheries eventually required the Norwegian authorities to act. These included damages to fishing gears including gillnets, longline and traps, and also directly to their catch (particularly cod and lumpsucker). Research and experimental fisheries became both Norwegian and Russian priorities from 1994 to 2001. The countries' goals included building a long-term fishery. In Norway, heated public discussion started among fishers in coastal Finnmark who continued to suffer from crab bycatch impacts.

In response, the Norwegian government opened up a commercial fishery in 2002 with quotas set in cooperation with the Russian authorities. As the initial purpose of the introduced crab

quota system in Norway was to compensate small-scale fishers who had suffered bycatch related losses, commercial king crab fishing in Norway took on significant community socio-economic impacts from its inception.

In Russian waters the experimental fishery continued until 2004 when the commercial fishery opened for the first time (Sundet and Hoel, 2016). Unlike the Norwegian fishery, the Russian fishery occurs offshore and ownership of the fishing fleet has become increasingly concentrated since that time (Acoura, 2017). The concentration, which manifests as a regional association, eased the flow of information and initiated the certification process itself. At the same time, the increasing concentration, the lack of transparency surrounding it, and the flow of profits within it, is one of the several challenges remaining in MSC certification for the Russian fishery.

In 2005, Norway and Russia agreed to establish a western boundary at 26°E along with a northern boundary at 71°30′N, that allows for an open-access fishery to the north and west of the Norwegian quota regulated area that begins at the Russian border (Sundet and Hoel, 2016). Despite the signed agreement of 2005 for joint research efforts via a three-year research program (2005–2007), and the agreements in force since 1993, Russia then established quota limits for the Russian zone unilaterally without previous notice to Norway. After this deviation from the cooperative agreements, in 2006, the two countries agreed to shift from joint to national management of the species separately within their respective EEZs (Eriksen, 2008).

Today, the purposeful introduction of the crab would violate the Convention for Biological Diversity (CBD), to which Russia and Norway are both party. In addition, as Arctic Coastal States in cooperation through the Arctic Council's working groups, successful invasive species management is a jointly determined goal. Furthermore, the Russians and Norwegians have a long history of fisheries cooperation; all current straddling stocks, with the exception of crab species, are managed jointly through the Joint Fisheries Commission. Thus, all regulatory and historical management incentives suggest that cooperation is not only desirable but feasible.

Over the years, however, the Russians and Norwegians have moved, as shown, from an initial non-cooperative introduction of the new commodity to a cooperative period targeting profitability, then back to a non-cooperative period with more complex goals (Sundet and Hoel, 2016). Currently, Russia manages the crab exclusively as a long-term fishery, ignoring invasion impacts. Norway manages the fishery with quotas only from the 26°E line and east to the Russian border, whereas to the west, and north of 71°30′, there is currently an open-access fishery (Figure 1).

Open-access is generally known to cause crowding externalities, rent dissipation and excess fleet capacity (Gordon, 1954; Schaefer, 1957; Bjørndal and Conrad, 1987); in many cases around the world open-access has led to overexploitation and collapse of fish stocks. For this reason it is seen as a major limitation for those fisheries seeking certification (Pérez-Ramírez *et al.*, 2012). In the case of the RKC in Norway, however, the regulator's goal in the west and north is to eliminate, through the use of the open-access, the spread of the invasion (Fiskeri-og Kystdepartement, 2007). The open-access fishery can therefore be seen in this case as a more sustainable approach to the ecosystem's resources than the outcome of a quota-management long-term fishery; it serves as a second-best solution to the RKC management problem that has a dual role as an invader and as profitable resource (Kourantidou, 2018), despite violating MSC's first principle of "Sustainability of the Stock." If MSC certification continues to rest on this principle without additional leeway for cases such as presented by the Barents Sea RKC invasion, it may in fact worsen efforts to reduce invasion impacts by e.g. incentivizing quotas over open-access.

Doing so could be attractive even in situations that resemble conditions in Norway's RKC fishery, where there has been explicit interest in curtailing the spread of the invasion. Despite the bycatches, which caused an increase in costs for Norwegian coastal fishers of an estimated 3–10% (gear-replacement costs and increased fuel expenses) (Sundet and Hjelset, 1999) over the first years of the introduction, the profits in the crab fishery in Norway have grown significantly larger and have recently surpassed those of many other small fisheries in the region. As the financial value of the crab fishery has started becoming more clear, perceptions of local stakeholders are moving toward favouring the use of the ecosystem for crab production rather than maintaining its current productive capacity (Eldorhagen, 2008; Broderstad and Eythorsson, 2014). Part of the risk lies in the fact that current ecosystem productivities may be uncertain, particularly in understudied marine ecosystems and their values to coastal communities (Garcia Rodrigues *et al.*, 2017).

Broader ecological concerns

The role of commercial harvesting for the management of invasive species remains controversial; the effectiveness of market incentive programs varies, especially in the existence of ecological uncertainties. Commercial harvesters may develop undesirable behavioural responses when market solutions to invasive species are attempted. Examples of this occurring include efforts to increase densities, intentional spread of the target species and introductions of the species into previously uninvaded areas to recreate the profitable market (Nuñez *et al.*, 2012; Pasko *et al.*, 2014). If certification, and subsequent further increases in prices for premium goods, goes unchallenged then these incentives are strengthened.

The first type of impacts that were identified from the RKC invasion, already by 1992, were bycatches in overlapping coastal fisheries in Norway (Fiskeri-og Kystdepartement, 2007; Sundet and Hoel, 2016). Other types of impacts that were identified later on include increased risks of infestations from parasites, symbionts and commensals (Bakay *et al.*, 1998; Jansen *et al.*, 1998; Hemmingsen *et al.*, 2008; Dvoretsky and Dvoretsky, 2015), predation upon native commercial species such as capelin, lumpsucker (and their eggs; Mikkelsen and Pedersen, 2012; Mikkelsen, 2013) and Icelandic scallop (Jørgensen and Primicerio, 2007), as well as competition with native species (Petryashov *et al.*, 2002; Gjøsæter *et al.*, 2016) and soft-bottom benthic fauna impoverishment (Anisimova *et al.*, 2005; Falk-Petersen *et al.*, 2011; Oug *et al.*, 2011; Jørgensen and Spiridonov, 2013; Fuhrmann, 2016; Jørgensen *et al.*, 2016; Pavlova, 2013; Oug *et al.*, 2018). The discrepancies in the ecology literature across space (in Russia and Norway) as well as the observed trends across time demonstrate the limited scientific consensus. We attribute this to different economic incentives for research, driven by diverging agency management objectives (Kourantidou and Kaiser, 2018).

These impacts, and their regional discrepancies, have generated substantial debate at the international level and in Norway, but to a lesser extent in Russia. This is evident in the disparate histories of research findings regarding ecosystem and other impacts from

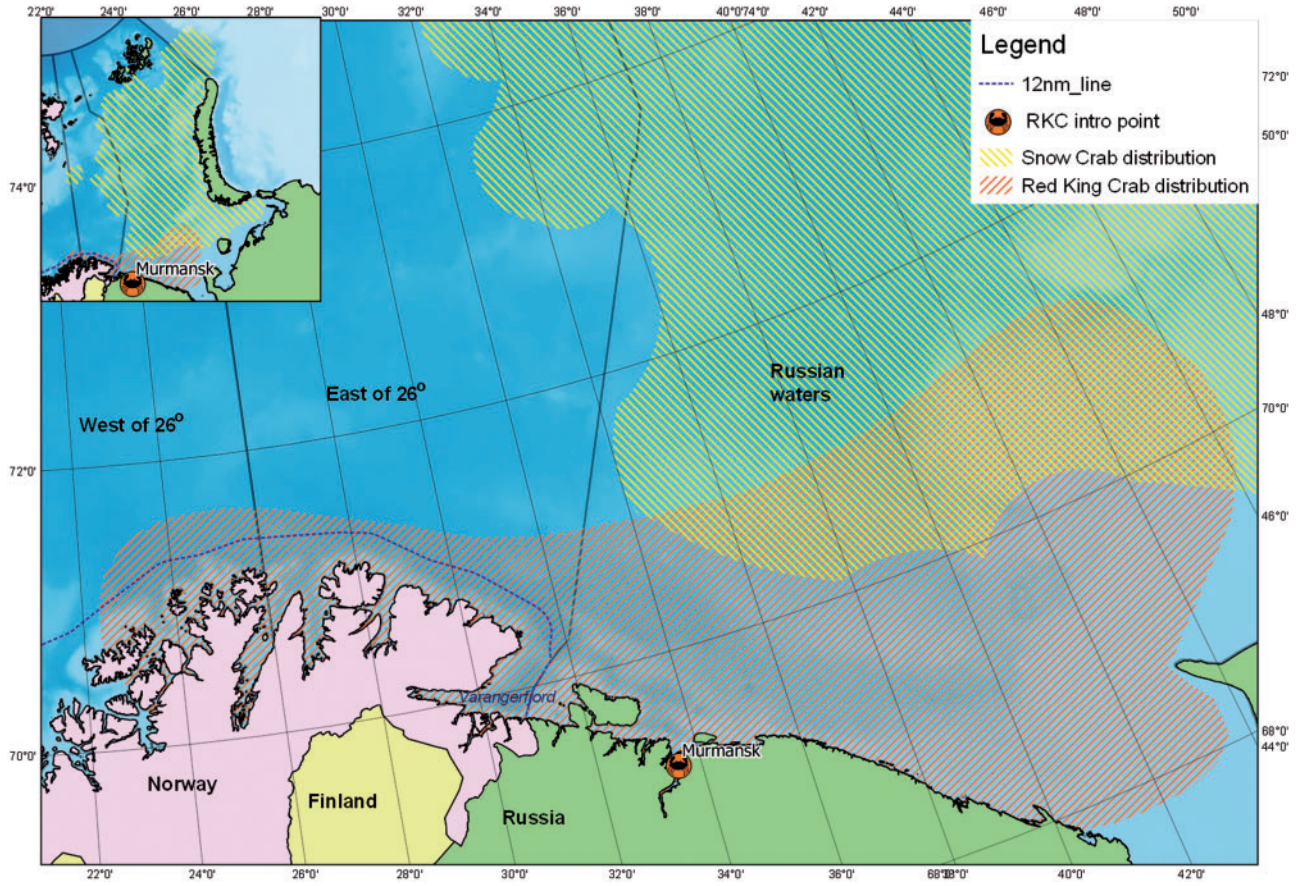

Figure 1. Distribution of the invasive Red King Crab and Snow Crab in the Barents Sea.

the spread of the crab in the Barents Sea, which show a lack of scientific consensus divided along national lines. The lack of consensus is on the one hand exacerbating the debate regarding its management, particularly in Norway, and on the other hand, measurably moving toward acceptance that the invasion should be allowed to determine a potentially new state of the ecosystem (Kourantidou and Kaiser, 2018). Certification of the Russian fishery entrenches this view ahead of any scientific consensus.

Political and social concerns

The Russian Barents RKC fleet consists of ten crab vessels working together for certification under a regional Association of Crab Catchers of North (Acoura, 2017). The MSC assessment report provides insufficient information about the formation of the monopolistic association or the quota acquisition process. That is, there is little understanding of who stands behind the Association and the extent to which ownership and profits are monopolized.

The allocation of crab quotas in the Russian crab fisheries lacks transparency and consistency. Without this information, the incentives of the fishing agents are unclear, so that it is not possible to know whether fishing activities are truly sustainable or simply aimed at monopoly rent-seeking. RKC quotas for the Far East and Barents are managed simultaneously, so that political and economic manipulations targeted toward the much larger Eastern RKC fishery also affect the monopolized Barents Sea fishery. In the early 2000s, quotas were distributed via auction, but since 2008, 10-year quotas were assigned based on historical catches (Gerden, 2018b). This has effectively barred entrance to newcomers. RKC prices continue to rise, and in 2018 a plan to return half the quota to an auction process, led by a "group of oligarchs and fishing tycoons" who want to join the fishery, would shift, rather than broaden, ownership at the expense of leading crab producers across the country. Western sanctions on Russia do not include food exports, so this remains one of few lucrative options for international trade (Gerden, 2018a).

The MSC certification process is based on 28 performance indicators, which build upon the Standard's three core principles: sustainable fish stocks, minimum environmental impact, and effective management (MSC, 2018b). The certification of the Russian RKC in the Barents is perfectly in line with the overarching goals of the first principle, which refer to practices that ensure a healthy stock status and prevention of overexploitation or recovery for depleted populations.

The second principle, on the other hand, requires that fishing operations allow maintenance of the structure, productivity, function, and ecosystem diversity (including habitat and associated dependent ecologically related species) on which the fishery depends. The principle's focus on protection of the habitat and, assumptively, the species on which the fishery depends, is narrow in the sense that it allows space for overlooking broader ecosystem impacts of the target species. While the assumption that habitat and species' protection should be aligned is highly reasonable in a more static world, climate change impacts may disrupt this close connection.

The public assessment report for the RKC (Acoura, 2017) does acknowledge that the ecosystem impacts from the invasion have been a concern for the scientific community (Annex *SD* [*SD*2.1.1] of the MSC Fisheries Standard addresses the requirements for considering assessment of introduced species and focuses on their ecological role [MSC, 2018b, p. 132]. In the peer review of the public assessment report, it is highlighted that reducing the scoring of Performance Indicator 2.5.1 due to the ecological impacts of the invasion would require an actual assessment of this impact in the report. The review also stresses that once it is accepted for assessment, the fishery should be treated as any other fishery. In response to this comment, there have been changes by the authors of the report "to remove the perceived implication" [Acoura, 2017, p. 176].). The report cites some of this literature and acknowledges the crab's impact on the benthic ecosystem but concludes that the effect is unclear with respect to ongoing change to that "total benthic ecosystem" and drivers such as climate change. This reservation did not, however, stop the MSC certification process or require additional scientific input that could increase the scientific consensus of these impacts.

According to the third principle there needs to be an effective management of the fishery that respects local, national and international laws and standards, and incorporates institutional and operational frameworks that require the use of the resource to be responsible and sustainable. The assessment report describes in detail the Russian fisheries legislation and discusses the compliance of the RKC fishery. Despite the fact that there is no cooperation between Russia and Norway on the management of the RKC, the report finds that "extensive" but informal cooperation among management authorities is sufficient and therefore characterizes the management as effective (Acoura, 2017, p. 59–60) (albeit at the low cost of a reduced Performance Indicator score [Acoura, 2017, p. 125]).

When it comes to international legislation such as the CBD, the analysis lags behind; the argumentation regarding why the deliberate introduction can be ignored centres around the fact that it occurred before the ratification of the CBD and that eradication is not possible according to selected quotations from the literature (Acoura, 2017, p. 11). This loophole is partially closed for introductions that started after 1993, the point at which the CBD became effective, or perhaps after a location has ratified the CBD, which for e.g. Russia is 1995. As the report notes, for a species introduced after the ratification of CBD, the introduction would have to be non-deliberate for the fishery to be eligible for assessment against the MSC standard (Acoura, 2017, p. 12).

A challenging role for government intervention

Though usually in concurrence with the MSC, the Monterey Bay Aquarium Seafood Watch program classifies the Russian Barents RKC as a product to "avoid," due to the inefficient management of the invasion and the hard-to-obtain supply chain information (Monterey Bay Aquarium's Seafood Watch, 2015). It recommends instead as a "Best Choice" alternative (a) the Alaskan native RKC for its healthy population, its low bycatch and habitat impacts, and its effective management, and/or (b) the Norwegian Barents RKC, for the provision of management authorities to limit the spread of the invasion. Larger global initiatives, such as the Global Sustainable Seafood Initiative (GSSI), do not always help inform consumers' choices in the context of a world-market. GSSI includes among its recognized schemes both the MSC and the Alaska Responsible Fisheries Management; the former has only certified the Russian RKC fishery whereas the latter has certified the U.S. Alaska Bering Sea and Aleutian Islands RKC fisheries. These controversies and disagreements open up the possibility that free market certifications are insufficient, warranting stronger government intervention. Still, government decisions will rest on the definitional framework for sustainability that they select.

The Seafood Import Monitoring Program (SIMP), established in late 2016, is a new government (US NOAA) initiative aimed at preventing IUU imports of certain seafood products to the U.S., including RKC (NOAA Fisheries, 2018). The newly established SIMP still fails to account for other indispensable features of seafood sustainability other than IUU practices.

The problem is broader than third-party certification and the lack of well-understood, consistent definitions of sustainable seafood. Government initiatives such as SIMP are meant to "add teeth" to certification programs, and to create credibility on all levels of resource sustainability. Control from state authorities, however, is often limited to only parts of the supply chain tied to the health of fish stocks, IUU fishing and frauds/misrepresentations of products. Third party certification and fisheries management rely on standards set by the industry itself. Though environmental organizations have a voice, they may not have the resources for full-fledged sustainability analyses. As evidenced by international treaties like the CBD, state authorities bear responsibility for assessing and understanding the ecological consequences of fishery activities.

Another avenue for government intervention may be product safety and liability laws that can foster efforts of other portions of the production chain, such as processors and exporters, to convey accurate information to end consumers. Technological solutions are growing; several companies barcode crabs upon arrival at the dock and add information throughout the supply chain, until the final consumer downloads the information. Such practices for product differentiation can be used not only as a marketing tool but also as a means of creating broader awareness among importers and consumers and in some cases can bypass the need for certification programs, if the practices are trusted and verifiable.

Implementation of such ocean-to-plate information systems among producers/exporters can be costly and can increase market concentration, countering other social goals and potentially creating more need for efficient government oversight in other dimensions. Such systems do, however, have the potential of providing competitive advantage to early adopters. Thus, we might expect to see more of them in the near future, and increasing competition in the most efficient implementation. For MSC standards, one implication comes from signalling theory (Lofgren *et al.*, 2002); a separating equilibrium between MSC certification and new, more detailed supply chain identifications can develop, with competition from the most easily verifiable and sustainable fishery production systems occurring first. This is especially likely if there are significant differences in costs or quality (Negro *et al.*, 2015). This will leave more uncertain and complicated cases as the base from which MSC fisheries can be selected. This could further dilute the transparency and reliability of the certification.

Consequences of certification limits

Objections to several MSC certified fisheries have been raised over the years; measured in tonnage, the catch involved in these objections amounts to more than one-third of the total MSC-

certified seafood (Christian *et al.*, 2013). The objections have focused on violations of all three major principles of the MSC Fisheries Standard discussed previously. The costs and difficulties involved in mounting such objections are significant (Christian *et al.*, 2013); media-friendly issues seem to have higher chances of successful opposition, as evidenced by the example that follows. The Gulf of St. Lawrence (GSL) Snow Crab (SC) fishery was MSC certified in 2012. A 2017 increase in the SC quota led to a longer season and more intense fishing activity. This increased the overlap and impact of interactions with marine mammals in the area, whose seasonal visits are growing longer with climate changes. Ship strikes and entanglements of North Atlantic right whales in SC fishing gear in the GSL then raised concerns about the highly endangered and charismatic mammal (Stokstad, 2017) and increased consumer awareness that the boundaries of MSC certification cannot sufficiently encompass these values and concerns. This led to the suspension of the certification in March 2018 (Seaman, 2018; MSC, 2018a).

There is growing awareness of MSC system limits. WWF, an original co-creator of the MSC standard, has started voicing concerns regarding the "accuracy and objectivity" of assessments as well as the standard's "ecological rigor"(WWF, 2018). Following criticism from different stakeholders, including scientists, fisheries, and conservation professionals, WWF has suggested reforms in the scientific support for MSC certification; those include reinforcing peer-review and scientific independence in order to reduce subjectivity in scoring, and ameliorating ecological concerns tied to e.g. marine mammals, endangered species, bycatch, discards, and vulnerable areas. The suggested reforms address labour issues, transparency, and the need to follow certified fisheries more closely (WWF, 2018).

A common concern tied to certification bodies like MSC is that they lay between fisheries and retailers/consumers; although the certification is assigned to third parties to ensure independent evaluation, the process is directly funded by stakeholders in the fishery under assessment, which renders adoption of reforms difficult. These stakeholders often see it as good opportunity to differentiate their product, increase revenues and expand their market reach. Although the certification itself uses third parties to ensure independent evaluation, the process is inherently industry controlled. Those seeking certification often see it as opportunity to differentiate their product, increase revenues and expand market reach. Additionally, the costs of assessment range widely ($15 000 to $120 000 USD) (Christian *et al.*, 2013; MSC, n.d.), with additional substantial annual audit fees (~$75 000) (Jacquet *et al.*, 2010). This risks conflicting interests due to economic incentives, as well as the inability of small-scale fisheries to bear the certification cost.

The MSC certification serves as a powerful tool that conveys information to seafood retailers and end-consumers. It is widely used by various national and international platforms such as the Marine Conservation Society, Ocean Wise, WWF, Monterey Bay Aquarium's Seafood Watch, and others. In addition to that, the MSC urges consumers and buyers interested in knowing whether a fishery has been assessed as "sustainable" to only look for the blue MSC label on seafood products. In this context, the use of the term "sustainable" can be dangerously misleading given that broader ecological, political or social challenges are ignored or deprioritized.

Risks from no action

One can see a resemblance in how the RKC fishery has evolved throughout time to the case of the Maine Lobster fishery, which Steneck *et al.* (2011) characterize as "gilded trap"—a type of societal trap where cooperative outcomes, such as those which have resulted in the Barents Sea RKC fisheries, or in MSC certification more generally, worsen overall well-being. This occurs because lucrative economic opportunities outweigh concerns about more diffuse and/or uncertain socioecological risks or consequences. As with Maine's lobster fishery, the RKC fishery rents in the Barents have been high enough for several years to boost development, local investments, and in some cases to create economic dependency for coastal communities (in Norway). These developments have shifted the focus away from treating the species as an invasive one, and have partly shifted the management away from an ecosystem management approach that calls for increased biological and economic diversity (Steneck *et al.*, 2011). MSC certification takes coordinated community action—even if that community is a cartelized regional association—and communities that take it generally do so with the intention of increasing the profitability of their resource. In cases like the one presented here, the gilded trap is a credible threat; certification promises to raise profits, but entrenches ecosystem changes that may be overall deleterious.

At the time of this writing (August–November 2018), the invasive SC in the Russian Barents (Figure 1) is under consideration for MSC certification. The SC fishery started in 2012 in international waters of the Barents Loophole. It entails larger ecological uncertainties attached to the invasion and has a much higher commercial potential (Kaiser *et al.*, 2018). The spread of the SC invasion is ongoing and affected significantly by climate change. Declining native populations in Alaska and Canada, together with increasing world market prices, are driving an increasing interest in the Barents SC fishery, which raises concerns that need to be echoed quickly by greater scientific and public engagement with the certification process, more comprehensive seafood certification standards, and broader public oversight.

Concluding remarks

Although there is no silver-bullet solution to whether certification systems should assess invasive species harvested commercially, it is not a trivial matter that should continue undebated. The flaws in the MSC certification of the Barents RKC add to the recent growing pressure for reforms in seafood certification systems and the MSC standard specifically. Our analysis calls for more theoretical work on the definition of sustainability that needs to go beyond the narrow definitions in place. These narrow definitions fail in taking broader ecosystem issues into account. Given the third-party certification problems identified, we suggest that solutions hinge on strengthening the role and broadening the scope of state authorities in the certification process; that is, solutions should allow for ecosystem considerations that go beyond the fishing industry's interests. Additionally, conflicting information among different certification platforms stresses the need to find ways to reduce disparities among certification schemes that confuse consumers. Existing efforts from government initiatives on seafood certification are, however, still limited to IUU practices, the health of fish stocks, and fraud in product labelling. Intervention in other parts of the production chain post fishing (e.g. processing, exporting, etc.) can help by refocusing

technological solutions that are currently focused on marketing purposes to deliver more detailed and accurate information to end consumers.

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