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Research Article

Fishing amongst industrial ghosts: The challenges of green sea urchin diversification in Eastern Canada

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Abstract

This article examines the Wolastoqiyik Wahsipekuk's green sea urchin fishery to explore the long-term implications of diversification strategies in response to ecological and economic precarities in the Canadian fishing industry. Framing diversification as a creative practice developed by commercial fishermen to navigate these vulnerabilities, it highlights how institutional frameworks shape and constrain such efforts. Drawing on ethnographic fieldwork conducted in Eastern Quebec during the summer of 2021, the article focuses on the specific regulatory context in which this initiative unfolds. Unlike some other First Nations in Canada, the Wolastoqiyik fishery remains closely tied to the models and oversight of Canada's Department of Fisheries and Oceans (DFO). An ethnographic analysis of the fishery's sociomaterial entanglements reveals both the promise and the limitations of diversification. Grounded in political ecology, the article argues that while expanding into emerging species may offer short-term relief, it cannot constitute a viable long-term response to the structural dimensions of the current ecological crisis. This calls for more transformative approaches to fisheries governance—approaches that challenge inherited management systems and engage with an era increasingly defined by socio-ecological unpredictability.

Keywords: Capitalocene; fisheries diversification; fisheries management; Indigenous fisheries; political ecology

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Résumé

Cet article se penche sur la pêche à l'oursin vert par les Wolastoqiyik Wahsipekuk pour étudier les implications à long terme des stratégies de diversification en réaction à la précarité écologique et économique de l'industrie de la pêche au Canada. En présentant la diversification comme une pratique créative adoptée par les pêcheurs commerciaux pour faire face à ces vulnérabilités, l'article met en évidence la manière dont les cadres institutionnels façonnent et limitent ces efforts. S'appuyant sur un travail de terrain ethnographique mené dans l'Est du Québec au cours de l'été 2021, il se concentre sur le contexte réglementaire particulier dans lequel ce projet se déroule. Contrairement à d'autres Premières Nations au Canada, chez les Wolastoqiyik, la pêche reste étroitement liée aux modèles et à la surveillance du ministère canadien des Pêches et des Océans. Une analyse ethnographique des enchevêtrements sociomatériels liés à la pêche révèle à la fois les promesses et les limites de la diversification. Fondé sur l'écologie politique, l'article soutient que si l'expansion de la pêche aux espèces émergentes peut apporter un soulagement à court terme, elle ne peut constituer une réponse viable à long terme aux dimensions structurelles de la crise écologique actuelle. Il est donc nécessaire d'adopter des approches plus transformatrices en matière de gouvernance des pêches, des approches qui remettent en question les systèmes de gestion hérités et qui s'engagent dans une ère de plus en plus définie par l'imprévisibilité socio-écologique.

Introduction

This article explores the long-term sustainability of fisheries diversification targeting emergent fisheries, with a focus on green sea urchin fishing in Québec, to assess whether this practice offers a viable solution to the ecological and economic precarity facing Canadian fisheries. Green sea urchin fishing is one of a few emerging fisheries in the St. Lawrence Estuary, fisheries that target "unfished or underutilized marine species" (Department of Fisheries and Oceans [DFO], 2008, para. 1). The only owner of a commercial green sea urchin license, the Wolastoqiyik Wahsipekuk First Nation, adopted this practice in the mid-2000s to diversify their exploited species portfolio in response to the combined pressures of climate change and market volatility (Michaux, 2012). This came with significant challenges. Fishermen who choose to exploit new and exploratory fisheries must navigate species-specific characteristics, emerging markets, and commercial networks while demonstrating the sustainability of their practices to regulatory authorities**.** Despite those factors, diversification appears to be an interesting strategy for fishermen seeking to adapt to shifting ecological and economic contingencies.

Accordingly, several authors have identified diversifying fishermen's species portfolios as a promising strategy to mitigate the risks associated with the unpredictability of the contemporary fishing industry, in which the livelihoods of participants are constantly challenged by commercial and ecological volatility (Kasperski & Holland, 2013; Cline et al., 2017; Epstein et al., 2018; Galappathi et al., 2019; Schowoerer et al., 2023). Although seemingly promising, recent articles also highlight the difficulties of access linked to this practice; diversifying, while theoretically appealing, often

requires large and risky investments that may be difficult to achieve for smaller fisheries (Anderson et al., 2017; Cline et al., 2017; Bennett et al., 2021). Furthermore, the profitability of these new fisheries—especially emergent fisheries—remains variable, complicating the guarantee of a return on investment (Anderson, 2017).

Nevertheless, without undermining these important challenges, it is crucial to go beyond purely economic rationales when considering the effects of fisheries diversification on fishermen's social well-being. These actors being too often represented, in economic analysis, as "disembedded and self-interested rational actors" (Pinkerton & Davis 2015, p. 303). Indeed, fisheries diversification can also serve as a way for fishermen to ensure the long-term stability of their practices. This idea is particularly important for Indigenous peoples in Canada, for whom diversifying can be a means of preserving an ancestral livelihood—fishing (Galappathi et al., 2021; Ouchi, 2022)—from which they have often been unfairly and violently excluded under colonial and imperial rationales, the effects of which remain active today (Charest, 2012; Ross-Tremblay, 2019; Todd, 2018). In this article, I will understand diversification through the exploitation of emergent fisheries as a creative measure through which fishermen negotiate the socio-ecological contingencies of the fishing industry. In the Wolastoqiyik Wahsipekuk case, although labour-intensive and sometimes financially complex, the development of this strategy demonstrates an awareness of the industry's vulnerable position and a willingness to move forward with innovative, albeit sometimes economically unfruitful, strategies.

While existing research has examined diversification within Indigenous-managed fisheries (Galappathi et al., 2021; Ouchi, 2022), the Wolastoqiyik Wahsipekuk case offers a distinct perspective on how regulatory constraints shape diversification strategies. Indeed, those do not occur in isolation; they are enmeshed in institutional and political structures. In Canada, the diversification of fisheries is regulated by strict conservation rules, including the New Emerging Fisheries Policy (DFO, 2008). Unlike some other First Nations in Canada, the Wolastoqiyik Commercial Fisheries remain tied to the regulatory framework of Canada's Department of Fisheries and Oceans (DFO) and its models. Given the significant social, political, and ecological dimensions at stake, this article, drawing on political ecology literature, will explore how these specific frameworks shape the long-term outcomes of diversification.

This specific case highlights the limitations of species diversification as a sustainability strategy within this contemporary framework. This contributes to the broader discussion on the sustainability of diversification strategies within institutional structures (Beaudreau et al., 2019; Abbott et al., 2023). In the Canadian context, Goetting (2008) demonstrated the failure of such strategies in the redfish industry of Nova Scotia, where insufficient consideration of ecological complexity led to poor outcomes. This raises important questions about the sustainability of diversification in other emerging fisheries, including green sea urchin fishing. Indeed, despite their potential for resilience (Folke et al., 2001), cases like the redfish fishery force us to consider the limitations associated with diversification under current models. Can a long-term strategy be implemented, or will emerging fisheries merely serve as short-term buffers, absorbing the unpredictability of the market? Here, I will argue that while diversification through emerging species may offer temporary relief, it cannot be seen as a long-term solution to the ongoing ecological crisis. This calls for innovative approaches to fisheries management—ones that rethink the foundations of current models and embrace the unpredictable conditions of our time.

To address these questions, the present article is structured as follows. The third section, following the methods, will focus on Canadian commercial fishing models. In view of the embeddedness of the Wolastoqey diversification strategy in this institutional framework, special attention must be given to it. I will conceptualize this model through the lens of political ecology, highlighting both its crucial role in protecting biological and socioeconomic resources and its limitations, particularly in forms of the countless unpredictable realities that escape conservation formulas. Recognizing the inherent precarity of conservation models, despite their importance, section four will examine how the Wolastoqiyik Wahsipekuk First Nation Commercial Fishery has responded to the insecurity surrounding their fishing livelihood by targeting emergent species to diversify their fisheries. In this part, I will focus on the development of the Québec only commercial sea urchin license, granted to the Nation in 2008, which has helped shield the business from economic and biological uncertainties in its primary fisheries—Nordic Shrimp and Snow Crab.

The final section will raise concerns about the long-term viability of such strategies. Emerging fisheries, like the Green Sea Urchin, are subject to the same uncertainties as traditional ones. Though less exploited, their conservation and commercial potential are still critical issues. Field data, collected through interviews and participant observation, reveal challenges such as unpredictable ecological shifts, knowledge gaps on emerging species, and limited resources. Without undermining conservation efforts, it is crucial to recognize the constraints of managing a model where accountability is key. Diversification through emergent species can help fishermen mitigate industry volatility in the short term, but within the current management model, it is not enough to ensure long-term sustainability. More structural and institutional changes are needed at the core of the model itself.

Methods

This article relies on data collected during a research project aimed at understanding the value of sea urchin fishing in Eastern Canada. Data were collected through ethnographic fieldwork in Eastern Québec between April and August 2021, focusing on the activities of the commercial fishing business of the Wolastoqiyik Wahsipekuk First Nation. During this fieldwork, I participated in sea urchin fishing activities and observed the business's infrastructure. The fieldwork observation sites included the fishing destinations themselves (see Figure 1), as well as public markets, related museums, fishmonger shops, and restaurants in the Bas-Saint-Laurent region.

Throughout this participant observation period, informal discussions with the fishing boat crew, market sellers, and other participants working closely with sea urchin marketing or fishing helped to nuance my understanding of the fisheries. These observations were supplemented by formal semi-structured interviews with eleven participants, including chefs, biologists, provincial and federal government administrators, fisheries managers, and individuals promoting regional fisheries. After transcription, these interviews were analyzed together with the data collected during participant observation through thematic analysis.

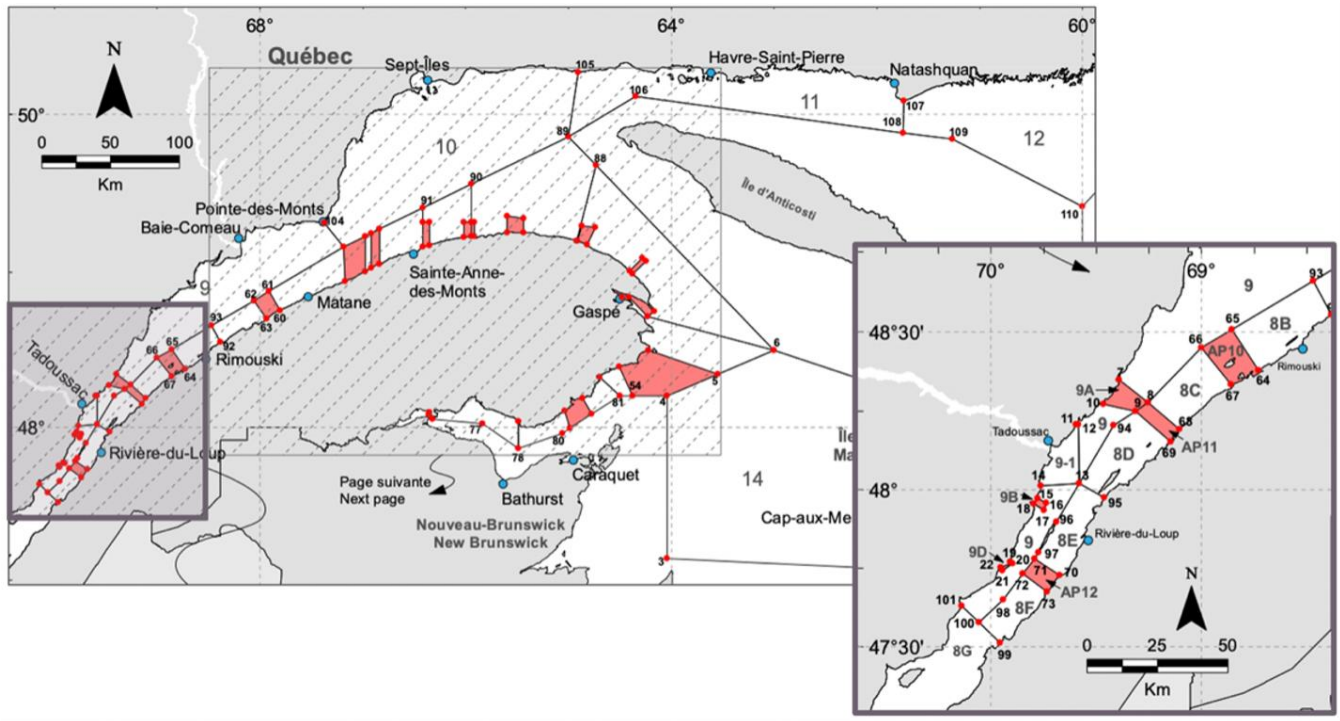
This ethnographic approach focused on the socio-ecological day-to-day operations of sea urchin fisheries.

While mindful of management models, observation and qualitative interviews allowed me to examine the material constraints of these models in practice—such as a lack of resources for planned evaluation and uncertainty among assessors regarding the viability of variables. Additionally, through the interviews, the pervasive uncertainty surrounding the future of these practices became evident among participants. Despite a strong belief in the necessity of management models, participants frequently highlighted the unpredictability of variables that these models could not account for (e.g., diseases, new predation, or climatic disasters).

The work of Jason Moore's (2017, 2018), which will be mobilized in this article, helps to further critique these models, revealing how capitalist approaches to natural resource management often ignore the precarious conditions of our current climatic era. These models, focused on quantifiable resource extraction, fail to account for the socio-ecological uncertainties in which food procurement systems are embedded. While emerging species may offer temporary relief, they cannot be seen as a long-term solution to the ongoing ecological crisis. This calls for innovative approaches to fisheries management—ones that rethink the foundations of current models and embrace the unpredictable conditions of our time. This article draws on political ecology to offer more than just critique; by focusing on the interdependence of social and environmental justice (Tsing, 2015; Larrère, 2018), political ecology provides pathways for creative solutions, allowing us to envision how fishermen's livelihoods can be balanced with pressing ecological concerns, fostering sustainable socio-ecological justice.

The present article emerges from the culmination of this data. What does it mean, in an era characterized by ecological precarity, to be entrenched in a model that requires stability? How can fishermen's willingness to follow models they know to be precarious help us rethink the foundational assumptions of these models? What can we do, in the current era, to help preserve livelihoods and ways of being? This research was conducted in accordance with the ethical norms of the three councils and with the approval of the ethics board of the University of Ottawa.

Figure 1 : Fisheries and Oceans Canada. (2013). *Carte des zones de pêche pour oursin / Fishing areas for urchin: Région du Québec / Quebec Region* [Map]. Government of Canada. https://www.qc.dfo-mpo.gc.ca/infoceans/sites/infoceans/files/OursinQuebec.pdf



Nature as numbers: Commercial management model in the scope of the Capitalocene

Canadian fisheries, whether emerging or established, are regulated by a complex system of conservation rules that seek to balance the biological limits of marine ecosystems with the socioeconomic needs of fishermen who rely on these resources for their livelihoods. These guidelines are primarily codified through the Fisheries Act (Government of Canada, 2019), but the foundations for these measures were laid much earlier. In the 1970s, in response to the growing concerns about the declining biomass of key species, like groundfish in Eastern Canada (Environment Canada, 1976) and aligned with international efforts to curb overfishing (Emery, 1993), the Canadian government moved to impose limited access to fishing stocks. This represented a pivotal shift from the previous "free-for-all" system (Environment Canada, 1976, p. 39) where unrestricted access had led to the depletion of vital marine resources.

The introduction of fishing licenses in 1975 (Department of the Environment, 1976), followed by the implementation of Total Allowable Catch (TAC) quotas in 1982, aimed to curb overfishing and introduce a system based on resource sustainability (Emery, 1993). The Fisheries Act of 1985 enshrined these licensing and quota systems into law (Government of Canada, 2019), marking a critical point in recognizing the finite nature of marine resources and the need for careful management. These measures, while far from perfect, introduced the concept of sustainability into the conversation surrounding Canadian fisheries. The key objective, as

noted by the Department of Fisheries and Oceans Canada (DFO) (1985, p. 8), was to "match the fishing effort to the available resource," balancing economic opportunities with biological constraints to prevent overfishing and ensure the long-term viability of fish stocks.

However, these systems were built on the assumption of relative ecological stability—an assumption that is increasingly challenged by the realities of the current ecological crisis. As climate change, species migration, and market fluctuations disrupt once stable systems, these traditional management models are proving insufficient. A deeper examination of how quotas and licenses are determined through the *Fisheries Act* (Government of Canada, 2019) illustrates the growing mismatch between static regulatory models and dynamic ecological realities.

The *Fisheries Act* (Government of Canada, 2019) grants the DFO the authority to "implement measures to maintain major fish stocks at or above the level necessary to promote the sustainability of the stock, taking into account the biology of the fish and the environmental conditions affecting the stock" (Government of Canada 2019, art. 6.1). This effectively mean that major fish stocks must be maintained "at or above the levels necessary to promote their sustainability" (Government of Canada, 2024, p. 3097). To calculate those level, DFO authorities rely on a Limit Reference Point (LRP). The LRP is defined as "the stock level below which productivity is sufficiently impaired to cause serious harm" (Government of Canada, 2024, p. 3097). If fish stocks fall below this threshold, conservation measures must be implemented.

Accurately calculating the LRP is therefore crucial for fisheries management. This value is determined by marine scientists working with the DFO's Science Branch. While the exact formula for calculating the LRP varies by fishery, it is primarily based on population models, surveys, and environmental data (DFO, 2009). As seen later in the case of the urchin fishery, scientific assessments are conducted periodically to estimate fish biomass, but annual adjustments to the LRP can be made based on continuous scientific monitoring and feedback from fishermen. This process ensures that quotas remain adaptable to shifting ecological conditions.

Once the LRP is established, DFO scientists and regulators determine the optimal exploitation rate—a percentage of the overall biomass that can be safely harvested without jeopardizing the species' long-term viability. The closer a stock is to the LRP, the more precautionary the recommended exploitation rate will be. If a stock falls below the LRP, strict conservation measures must be enforced. While the methodology for determining this precautionary threshold evolves with scientific advancements, the current guiding principles are outlined in the *Guidelines for Implementing the Fish Stocks Provisions in the Fisheries Act* (DFO, 2022a).

After the optimal exploitation rate is determined, the DFO can set the Total Allowable Catch (TAC), which represents the total quantity of fish that can be harvested from a specific stock. Individual Quotas (IQ) are then allocated within this overall limit, specifying the portion of the TAC assigned to individual license holders. An IQ is defined as "an amount of fish from a specific stock that is allocated to a particular licence holder through a condition of the licence" (DFO, 2024a, chap. 2, art. 9.19). While IQs serve as a key conservation policy, additional measures—such as restrictions on season, timing, effort, or fishing methods—can also be implemented to help preserve stocks (DFO, 2022a). These quotas regulate access rights for commercial license holders.

Licensing policies serve as another important management tool, helping regulators balance ecological

sustainability with the livelihoods of fishermen. By controlling access to fishing licenses, the DFO can address both conservation concerns and economic stability within the fishing industry. As a result, commercial fishing licenses are strictly regulated. Their allocation within the fisheries management framework remains flexible and subject to regional variations, with guiding principles outlined in the DFO database (DFO, 2024a). Generally, to qualify for a fishing license, an individual must meet the DFO's definition of a "core fisherman." This status requires fulfilling specific criteria for inshore vessel-based fishing licenses, including being the head of an enterprise or fishing unit, holding key licenses, maintaining a strong connection to the fishery, and depending on it for their livelihood (DFO, 2024b). While licensing policies may vary regionally, they are all tied to national principles advising precautions (DFO, 2009).

In Eastern Canada fisheries, at the time of my fieldwork, no new core enterprises were created, as explained to me by Marie-Ève, who was working in the licensing division of the DFO at the time: "We don't create new cores. A newcomer—say, a young person wanting to become a fisher—can only enter by taking over an existing business.... The DFO doesn't issue new licenses unless one is surrendered" (Interview, Marie-Ève, 2021 [originally in French; translation from the author]). This was due to what I can best translate as a "living wage principle," as explained by André, also working for the DFO: "You don't issue twenty licenses if fishers will barely make $1,000 a year. You issue just one so they can earn a living" (Interview, André, 2021 [originally in French; translation from the author]).

To summarize, licenses are only issued if the total fishable biomass can support a number of fishermen earning a livable wage. This ensures that over-exploitation is avoided and that each licensed fisherman holds a sustainable share of the TAC. In the current era, where precaution is identified as key (DFO, 2022b), no new licenses for major exploited species are attributed, protecting fishermen's socioeconomic interests in case of ecological fluctuations. Once issued, however, these licenses become permanent assets for the holders and cannot easily be revoked. This can complicate profitability when the biomass of a species fluctuates or market conditions change, as licenses remain fixed even as ecological and economic conditions shift.

This regulatory system, while essential in controlling overfishing, operates under the assumption of stability and predictability—assumptions increasingly at odds with the unpredictable dynamics of the natural world. This tension is highlighted by the growing precarity of long-established fisheries, such as Québec's mackerel and northern shrimp fisheries (DFO 2023a, ; DFO, 2023b), where quotas fluctuate due to environmental changes, and fishermen find themselves struggling to adapt.

As this system shows, fisheries management in Canada is deeply intertwined with the idea of nature as a calculable resource, bound by quotas and fixed licenses. While this system aims to prevent overfishing, it fails to account for the increasing ecological and economic instabilities fishermen face today. Viewed through the lens of political ecology, these models reflect the inherent limitations of trying to manage a dynamic and often unpredictable environment with static, rigid frameworks. This issue is further compounded when examining how these models apply to emerging fisheries like those explored by the Wolastoqey Fisheries, where the challenges of balancing socioeconomic and ecological needs become even more apparent.

In this section, before delving into the specific case study of the Wolastoqiyik's diversification initiative, I will explore how Jason Moore's Capitalocene framework can help us better understand the precarity

inherent in our established fisheries model. Moore's critique provides a theoretical lens for examining how capitalist-driven management systems, though well-intentioned in their conservation goals, often exacerbate ecological instability by treating natural resources as quantifiable and ownable. This approach, while helpful in creating short-term protections, can fall short when faced with the complexity and unpredictability of real-world ecological systems.

The term Capitalocene is a play on the more widely used idea of the Anthropocene. In 2000, geologists Paul J. Crutzen and Eugene F. Stoermer (2000) proposed the term Anthropocene—"the epoch of human imprint upon all earth systems from the geologic to the biotic, from the chemospheric to the hydrological, and from the cryospheric to the atmospheric" (Howe, 2019, p. 2)—to mark the most recent geological era, dating back to the Industrial Revolution. This concept has gained widespread traction in both academic discourse (Chakrabarty, 2009; Larrère, 2015; Haraway et al., 2016; Moore, 2017; Howe, 2019) and popular literature (Moore, 2017, 2018). The term's popularity stems largely from its ability to highlight the role of human activities in driving the current climate crisis. By emphasizing the extensive impact of anthropic pursuit on planetary systems, the Anthropocene forces a reckoning with the undeniable relationship between human action and ecological change (Oreskes, 2007; The Intergovernmental Panel on Climate Change [IPCC], 2022).

In this sense, the Anthropocene prompts a reassessment of the long-standing scientific foundations of ecological thought, where nature was seen as quantifiable, static, and separate from human society (Larrère, 2015). The concept allows us to question the static and linear sense of modern history (Chakrabarty, 2009; Larrère, 2015). Indeed, modern Western ethical projects were grounded in a rigid separation between nature and society (Latour, 2017; Charbonnier, 2020), with the assumption that scientific and technological growth would ultimately lead to the emancipation and social justice of humankind (Audier, 2017; Latour, 2017; Charbonnier, 2020).

Although such development projects have faced critique from their inception (Audier, 2022), theoretical frameworks helped sustain the modern belief in "temporary" exploitation of nature (Vivien, 2001; Rosa, 2010), assuming that humans could transcend natural limits through progress. However, the Anthropocene violently exposes the impossibility of separating human progress from the natural world's limitations. It shows that human actions have permanent consequences on all of the Earth's systems, with the current climate crisis serving as a striking example. By emphasizing the interdependence of nature and culture, the Anthropocene opens new questions (Rademacher, 2015; Knox, 2020), including how our food procurement systems are organized (Tsing, 2015).

Despite its utility, the concept of the Anthropocene has faced substantial criticism (Haraway et al., 2016; Moore, 2017, 2018; Ghosh, 2021). Jason Moore (2017, 2018), in his development of the Capitalocene framework, presents some of these critiques. He argues that the Anthropocene, in many ways, remains too anthropocentric. Moore emphasizes that the root cause of the current climate crisis is not all of humanity but specific actors: capitalist, Western, and imperial powers. Indeed, in documenting the transformation of the relationship between power, capital, and nature during the long sixteenth-century (1451–1648), Moore (2015) demonstrates how the extraction of natural resources—justified as part of a liberal emancipation project—was central to the rise of modern imperial powers. Facing the erosion of feudal power due to social, climatic, and demographic shifts linked to the Little Ice Age, imperial nations needed to reaffirm their hegemony. With

limited land available in Europe, these powers sought new ways to generate value by developing tools and techniques to turn human and extra-human labor into productive resources. These tools—such as surveying, mapping, and accounting—focused on increasing labor productivity and expanding territorial control. By exploiting "cheap nature"—namely labor, energy, food, and raw materials—imperial nations stabilized their internal power through colonial and imperial projects, starting in the late fifteenth-century (Moore, 2017, 2018). This era gave birth to modern capitalism. Moore argues that this view of nature—as something quantifiable, controllable, and exploitable—forms the foundation of the current climate crisis.[1]

This legacy continues today in space such our food procurement systems. Tsing's (2018) conceptualization of the plantation is particularly useful for understanding this process. The plantation model—an ancestor of contemporary industrial monocropping—offers a clear example of how complex natural ecologies are reduced to accountable and controllable entities in service of capitalist and imperial interests. As Tsing demonstrates, monocrop farming achieves productivity by simplifying diverse ecosystems into a single species through violent processes that alienate both labor and ecology. This not only exemplifies the violence inherent in industrial agriculture but also exposes the hidden, pernicious impacts on those working within these systems. For example, Tsing highlights the outbreak of coffee rust (Tsing et al., 2019) to illustrate the impossibility of fully erasing socio-natural dynamics from plantation environments. Despite efforts to suppress or ignore these ecological forces, they frequently re-emerge in the form of fungi, diseases, or parasites. These elements, excluded from management models that seek to erase their existence, often wreak havoc on the systems dependent on plantation economies, leading to disastrous outcomes for both workers and communities, who rely on these models for stability.

Through her work, Tsing does not place blame on producers or consumers who seek to improve their living conditions. Instead, she critiques the taken-for-granted stability of the models that underpin industrial agriculture. In a co-authored article with Neil Bubandt and Andrew Matthews (2019), she stresses the importance of ecological models in managing the complexity of our world but warns against the tendency to treat these models as infallible. Models, as the authors remind us, are essential for making sense of the complexities of our contemporary world. After all, it was scientific models that helped define the Anthropocene, consolidating vast amounts of data into a clear picture of the current era's environmental challenges. However, model thinking has its dangers, as "both model thinking through simplification and thinking by example have their place. But Viveiros de Castro reminds us of the dangers when 'models of' become normative 'models for' that inspire authoritative simplifications—sponsored by states and corporations—that destroy landscapes and silence other visions of the world [Law 2015]" (Tsing et al., 2019, S191).

It is precisely this dangerous simplification of models—promoted by capitalist and imperial interests—that Moore's Capitalocene warns against. The term Capitalocene articulates the forces driving ecological devastation through the reduction and control of nature. In the next section, I will demonstrate how the current Canadian fishing model, while beneficial in managing the socioecological impacts of fisheries, remains itself deeply rooted in the

[1] See also Charbonnier, 2020.

same conception of natural resources as quantifiable and ownable. Understanding these limitations is crucial not only for critiquing existing models but for fostering innovative and sustainable approaches to fisheries management that move beyond the capitalist frameworks of exploitation.

Green sea urchin fishing: Creativity in the face of unknown conditions

The launch of green sea urchin fisheries by the Wolastoqiyik Wahsipekuk First Nation in 2008 highlights the shortcomings of Canadian management models for fishermen while also showcasing the creative actions, such as fisheries diversification, that Indigenous actors have taken to maximize the durability of their practices. The commercial fishing activities of the First Nation began operations in 2000, shortly after the Marshall Decision (R. v. Marshall 1999). This landmark ruling, resulting from the legal battle of Donald Marshall Junior, a member of the Mi'kmaq First Nation, recognized the constitutional right to commercial fishing granted by the 1760 Halifax Treaty of Peace and Friendship between British colonial authorities and First Nations in Eastern Canada. Prior to this decision, the Wolastoqiyik Wahsipekuk First Nation, one of the treaty's signatories, was excluded from commercial fishing. The ruling allowed them to establish Les Pêcheries Malécites, which initially focused on Snow Crab and Nordic Shrimp.

As explained by Joël, who at the time of my fieldwork was working in the management of First Nation Fishing Activities, as newcomers to commercial fishing entering the industry during a period of unprecedented moratoriums, the Wolastoqiyik faced significant challenges: "After the Marshall judgment, First Nations in Eastern Canada, like the Mi'kmaq and Wolastoqiyik, received commercial fishing licenses. The first ones given to us were for snow crab and Nordic shrimp. It was all new for First Nations, who had no experience in commercial fishing. Honestly, in the beginning, we were maybe the laughingstock of the industry. There was a lot of outsourcing, and many of the workers had no idea what they were doing" (Interview, Joël, 2021 [originally in French; translation by the author]).

Tensions within the industry remained high, as the allocation of new licenses affected quotas and wages. Conflicts were frequent in the early 2000s, with notable riots in 2003, which resulted in the burning of several fishing boats. Beyond these tensions, the Wolastoqiyik were confronted with the high cost of commercial fishing equipment and the need for extensive training to establish themselves in the industry. To ease their entry, they signed agreements with the DFO in 2000 and 2001, receiving financial and technical assistance. In return, they had to comply with DFO regulations, including the Fisheries Act of 1985 (Michaux, 2012). This is significant because, while Indigenous fisheries collaborate on conservation measures with the DFO, they are not always subject to the same legal frameworks as Canadian commercial fishermen.

With time and experience, the business grew and developed their expertise. Joel reflected on this progression, noting the significant strides made by First Nations fisheries: "Slowly but surely, First Nations gained experience and became more involved. They started controlling costs and quality, increasing their presence in the workforce. Over time, Indigenous fisheries, not just Les Pêcheries Malécites, became real forces in Eastern Canada" (Interview, Joël, 2021 [originally in French; translation by the author]). This

progress was not just about gaining experience; it was also about embracing flexibility and creativity in their practices. Through targeted training, strategic collaborations, and resource management improvements, the fishery began to control costs and improve product quality, securing a stronger presence in the market.

At its start, the Wolastoqiyik received fishing licenses for two species: Nordic Shrimp and Snow Crab. This meant their catches were limited to these species, with quotas (Total Allowable Catch) set annually by the DFO. Both shrimp and crab have been key components of fisheries in the St. Lawrence Estuary since the second half of the twentieth-century (Morse, 2014). Today, these species, along with American Lobster for fisheries with Atlantic access, account for most of the volume and profits of Eastern Canadian fisheries. Nordic Shrimp and Snow Crab are particularly valuable species (DFO, 2021), yet their reliance on these species left the fisheries vulnerable to market fluctuations and environmental changes, underscoring the need for diversification.

In the mid-2000s, the management of the business grew particularly concerned. On one hand, a still recent cod moratorium had raised general doubts about the reliability of DFO models. While relationships between scientists and fishermen had somewhat improved, tensions still simmered. Michel, a former member of the Fishing Resource Conservation Council, reflected on the difficult period in the early 2000s: "Before the moratorium, the scientific work.... Biologists worked in the secrecy of their laboratories, within Fisheries and Oceans.... After the moratorium, the fishers started to speak up, right after the moratorium in ninety-two, ninety-three, saying, 'This doesn't make sense, we don't know what's happening, we don't know what the biologists are doing'.... And so, this famous Fisheries Resource Conservation Council (FRCC) was created to present scientific opinions to the public, gather industry input, and then make public recommendations to the minister.... But it was always very tense. The relationship between research and fishers are extremely ambiguous" (Interview, Michel, 2021 [originally in French; translation by the author]).

The efforts of the FRCC did help bridge some of the gap between scientists and fishermen. Nevertheless, some tensions persisted, fueled by ongoing concerns about quota size and management. The Wolastoqiyik were particularly worried, not just about past mismanagement but also about current fluctuations in crab and shrimp populations and market prices. Although the shrimp population in the St. Lawrence was stable, the influx of farmed shrimp from Asia was driving down the market value of Canadian shrimp, putting further pressure on local fishermen (Michaux, 2012; Gouvernement du Québec, 2018). The situation for Snow Crab was even more serious. Along with market pressures from Russian and Alaskan crabs, biologists noted a decline in snow crab populations in the mid-2000s, potentially signaling overexploitation. The combination of decreasing quotas and declining populations raised urgent concerns about the sustainability of the fishery.[2]

[2] The shrimp and crab case, while not my focus, are interesting in the context of this article. For snow crabs, a better understanding of their reproductive cycles, which naturally fluctuate over long periods, has calmed initial fears about biomass variation. On the market side, shrimp prices have significantly improved after a low in 2010, with prices steadily increasing since (Gouvernement du Québec, 2018). However, northern shrimp faces growing concerns due to its vulnerability to climate change, the formation of a hypoxic zone in St. Lawrence, and the return of Atlantic cod, its primary predator (DFO, 2023b). While not the core focus of this article, these examples emphasize the rapid changes in resource availability driven by evolving market conditions and environmental factors, creating instability in an industry that relies on a calculated exploitation of ecological and economic resources.

As the Wolastoqiyik faced growing uncertainty about their reliance on shrimp and crab, they began seeking solutions to secure their future. One of the few available options was fisheries diversification through the exploitation of new and emerging species. While this article focuses specifically on the Wolastoqey's cases, they were not alone in adopting such measures. Linda, who promotes the consumption of emerging fish products in Québec, recalls a significant moment when diversification efforts began to resonate with even the most traditional cod fishermen in the region. During a 2008 presentation of a sustainable fishing initiative linked with fisheries diversification, Linda noticed an unexpected reaction from a Gaspé fisherman, representing the traditional fishing community. This moment captured the shift in the mindset of fishermen who had long relied on more established fisheries: "It was a cod fisherman who saw the possibility of saying, 'We're going to diversify our fishing, and we're going to diversify our income.' And just like that, this man said, 'My son will be able to take over the boat and continue fishing.' There was a vision for the future, planning like we had never heard before or never allowed the fishermen to express [originally in French; translation by the author]." (Interview, Linda, 2021)

It is in this context that in 2006, the Wolastoqiyik began requesting new fishing licenses from the Canadian government to diversify their activities. Under the New Emerging Fisheries Policy, Indigenous fisheries were granted privileged access to licenses for emerging species. This policy aimed to mitigate the profound impacts of colonial policies that had historically excluded Indigenous communities from commercial fishing. As part of this initiative, the fishery received a commercial green sea urchin fishing license in 2008—unique in the Québec region—along with 10 other fishing licenses.

It should be noted, however, that this step toward diversification did not immediately translate into significant financial gains for the Wolastoqiyik. While financial stability was a concern for the Nation—given that fishing revenue was their primary economic driver at the time—the Wolastoqiyik began investing in forestry, aquaculture, and tourism to achieve broader economic stability (Michaux, 2012). Diversification, though expected to be profitable, was aimed more at ensuring the survival of their commercial fishing activities, which hold inherent value as ancestral livelihoods (Charest, 2012; Michaux, 2012). Profits from emerging fisheries, however, have proven difficult to attain. As the administrator of the business describes: "Outside of the holy trinity of crustaceans: Nordic shrimp, lobster and snow crab, there is very little or nothing. Well, now, you have Atlantic Halibut which, in the fish categories, is the best of the best. But, outside of the halibut, there are very few fisheries that are" (Interview, Joël, 2023 [originally in French; translation by the author]).

While Atlantic halibut has proven more profitable, the commercialization of other new species has faced challenges. The case of green sea urchins is a particularly illustrative example of these difficulties.

The interest in green sea urchins from Canadian waters emerged in the aftermath of the collapse of the Japanese green sea urchin population due to overfishing in the 1990s (Sun & Chiang, 2015). As urchins are considered a luxury item in Japanese markets, the collapse of their local stocks forced Japan to seek new sources, thereby boosting international demand for the species (Sonu, 2017). Inspired by the success of Maine's fisheries (Johnson et al., 2012), entrepreneurs began green sea urchin fishing in the St. Lawrence Estuary during the 1970s. However, the expected economic triumph never materialized in Eastern Canada. Despite the increasing global demand and the high market

prices for Canadian sea urchins (Sonu, 2017)—especially after the collapse of Maine's fisheries due to overfishing (Johnson et al., 2012)—several factors limited the potential for substantial profit.

The biology of the green sea urchin plays a significant role in its commercial value, as the edible parts are the reproductive glands, or gonads. Larger gonads increase the urchin's market value. In the St. Lawrence Estuary, gonads reach their peak size in the spring. However, after spawning in April, the gonads shrink, leaving a short window between the thawing of river ice and the spawning period for fishermen to harvest urchins, all while adhering to daily and annual quotas. During this period, prices are higher, as urchins from other North American regions, such as New Brunswick, have not yet entered the market. By fall, gonad sizes recover, allowing for renewed harvesting, but market prices decline due to increased competition.

Moreover, the focus on gonads complicates the fishing process. Gonad quality is primarily evaluated based on size and color. However, Canadian fishermen cannot assess the color of the gonads without opening the urchins, which kills them and renders them unsuitable for export. Although divers can estimate urchin quality based on seafloor conditions, this method is time-consuming, prone to error, and challenging given the short fishing season. Other fishing methods, such as using a small dredge or traps, have been tried in the past but were ineffective at sorting urchins by quality. As a result, manual harvesting by divers remains the most commonly used method, despite being labour-intensive and costly.

Additionally, the limited volume of local urchin harvests complicates processing, making it unfeasible to establish a dedicated transformation plant. As a result, Canadian fishermen must rely on American intermediaries to access Asian markets. Increasing the volume of harvested sea urchins is also difficult, as while green sea urchins are abundant in the St. Lawrence Estuary and Gulf of St. Lawrence, few have access to the green laminaria diet necessary for developing commercial value.

Finally, despite efforts to promote sea urchins in Québec, they are still rarely consumed locally. In 2021, during my fieldwork, 100 percent of commercially fished sea urchins from Québec were exported, primarily to Japan, according to the Wolastoqiyik. The export process further complicates profit margins, as Japanese consumers—who account for over 90 percent of global sea urchin demand—have highly specific aesthetic preferences (Bestor, 2004). In addition to gonad size, external factors such as the size and color of the urchin's body are critical, though not necessarily linked to taste. This increases the challenge for fishermen, who must consider these standards during harvesting. Moreover, the cost of shipping live urchins, which are heavy and require careful temperature control, is prohibitive for many fishermen, making post-harvest transformation essential.

Due to the limited number of licenses issued for sea urchin fishing, commercialization statistics are protected by the DFO, making it difficult to assess exact figures. Nevertheless, several factors, including the fact that all commercial sea urchin fisheries in Québec—except Indigenous fisheries—have ceased their activities since the 1970s, suggest that the fishery remains economically insignificant compared to other activities such as shrimp and crab fishing. Les pêcheries Malécite has argued that sea urchin fishing is a negligible source of profit. Although not as profitable as shrimp or crab, green sea urchin fishing offers a form of security by diversifying the portfolio of species being harvested, helping the Wolastoqiyik to remain resilient against environmental or economic fluctuations. Other studies in different contexts have also shown how diversification can help fishermen gain social security

and protect fisheries against ecosystemic instabilities (Anderson et al., 2017; Cline, 2017; Teh et al., 2017).

In this case, the motivations of these individuals are not in question; diversification is understood as a creative measure through which fishermen negotiate the socio-ecological contingencies of the fishing industry. What I want to discuss, however, is the sustainability of this strategy, which requires significant effort from those who pursue it. If diversification is, for some, despite the complications associated with developing new techniques and markets, used to ensure sustainability (as argued in Charles, 2001; Morgan et al., 2014; Roscher et al., 2022), it is essential to examine the sustainability of these activities themselves.

Fisheries diversification: Ensuring precarity or precarious insurance

Fisheries diversification has been presented as a strategic response to the uncertainties facing the fishing industry, which is continually disrupted by ecological changes and volatile international markets. However, I argue in this section that diversification alone is insufficient to secure sustainable futures for those who depend on it. Using the green sea urchin as a case study, I will demonstrate that not only is sea urchin fishing itself inherently precarious but that the expansion into new and exploratory fisheries, under current fisheries management models, may exacerbate instability within the sector. The framework through which exploratory fisheries are regulated—while differing in some respects from conventional fisheries—is still grounded in the same assumption: that the resources of the natural world can be precisely quantified and transformed into manageable variables. In practice, I will argue that this ideal is difficult to attain in fisheries management, where limited resources and incomplete data must contend with the ecological unpredictability of our changing times.

Before delving further into the discussion, it's important to clarify the two primary types of commercial fisheries operating in Eastern Canada: limited access fisheries and emergent fisheries. Limited access fisheries, such as those targeting snow crab and shrimp, involve well-established commercial licenses owned by either individual fishermen or larger enterprises. Each species fished requires its own specific license, making these licenses crucial assets for fishing operations. For many fishermen, they represent not only a source of livelihood but also their main retirement fund. As DFO administrator Marie-Ève explains: “We no longer create new core enterprises. A young person who wants to enter the fishing industry today can only do so through the transfer of an existing business. In these cases, a core enterprise must retire for a new one to take its place. We call these limited access fisheries” (Interview, Marie-Ève, 2021 [originally in French; translation by the author])

These licenses, often passed down through generations, have become highly valuable commodities. However, as discussed earlier, the increasing uncertainties brought on by climate change, fluctuating market prices, and declining biomass threaten their long-term viability. While the DFO discourages the concentration of licenses in a few hands, its New Emerging Fisheries Policy (DFO, 2008) encourages fishermen to diversify their catch to navigate these shifting environmental and market conditions.

Emergent fisheries, targeting underexploited species, are governed by a distinct regulatory framework, though they follow a conservation rationale similar to that of established fisheries. The New Emerging

Fisheries Policy (DFO, 2008) is designed to regulate these budding fisheries by balancing economic opportunity with the need for resource protection. This policy mandates a phased approach for establishing a new fishery, allowing for careful monitoring at each stage:

1. *Experimental stage*: This step focuses primarily on assessing the ecological integrity of the resource. It requires preliminary data on the species: whether there are areas with commercially viable quantities and whether populations are large enough to support long-term exploitation. The costs of this phase fall on the industry, which is not yet permitted to commercialize the resource.
2. *Exploratory stage*: This more extended phase assesses the socioeconomic potential of the fishery. Is the resource marketable? Can fishing activities generate sustainable profits? At this stage, fishermen are allowed to sell their catch, but they must frequently renew their temporary licenses.
3. *Commercial stage*: Once it is demonstrated that the fishery is both ecologically viable and commercially profitable, an exploratory license may be converted into a permanent commercial license, which can then be owned and resold by the core enterprise.

It is important to note that not everyone can access these emergent fisheries. Indigenous fisheries are given priority, partly as a response to the historical exclusion of Indigenous communities from commercial fishing opportunities. The re-establishment of their commercial fishing rights grants them privileged access to these licenses. For other fisheries, however, access is often restricted to existing core enterprises. As explained by Marie-Ève, in charge of managing emerging licenses in Québec: "To obtain an exploratory sea urchin license, you need to be a core enterprise. A core enterprise generally holds licenses for several key species and is expected to operate profitably. Diversification is often necessary, but it requires an established base fisheries" (Interview, Marie-Ève, 2021, [originally in French; translation by the author]).

Thus, emergent fisheries licenses are not designed to create new businesses but to allow existing core enterprises to diversify. This process requires significant investment, and not all exploratory fisheries transition into successful commercial ventures. Additionally, participation clauses ensure that speculative fishing is minimized, as fishermen must continually invest and maintain their exploratory licenses.

While the New Emerging Fisheries Policy offers flexibility and encourages innovation, the considerable costs and risks associated with experimental and exploratory phases limit the accessibility and popularity of these fisheries. Several interviewees expressed that these fisheries remain marginal within the broader industry. Despite the heavy financial and operational burdens of exploring and developing new fisheries, the policy does provide an important pathway toward diversification and necessary conservation measures. However, as the following example illustrates, the application of these measures in practice presents significant challenges.

First, the human and financial resources required to conduct proper scientific evaluations of biomass are substantial. As mentioned in the second section, the quotas for Canadian fisheries are typically determined through the calculation of an Optimal Exploitation Rate, which is based on the species' biomass. Although exploratory licenses differ in stability from those of established fisheries, the process of quota calculation for species like the sea urchin still relies on the Optimal Exploitation Rate. To illustrate the practical challenges of this approach, consider the example of the sea urchin. Researchers from the Maurice-Lamontagne Institute (IML), affiliated with the Department of Fisheries and Oceans (DFO), are tasked with assessing the exploited sea urchin populations in the St.

Lawrence River. During these surveys, researchers either dive personally or use underwater cameras to count the sea urchins in specific sub-zones. This allows them to estimate the number of sea urchins per square meter and, by extension, calculate the total population in the region. Although the method seems straightforward, these surveys are time consuming and expensive. André, an IML biologist who conducted these evaluations for several years, noted the difficulty: "These surveys are very laborious, very costly. We don't conduct them annually, but we do them from time to time" (Interview, André, 2021 [originally in French; translation by the author]). Despite the significant investment, the importance of these assessments is clear, as ecosystems are dynamic and require regular monitoring. The DFO recommends stock assessments every three years, but the practicalities often complicate this schedule. Given that sea urchin fishing is not widespread in the estuary, it is a low priority for management. Marie-Ève points out the consequences of limited resources: "It's been almost ten years since we've had a stock assessment, but this is a species that should ideally be evaluated every three years." (Interview, Marie-Ève, 2021 [originally in French; translation by the author]). While this process is sound in theory, it raises crucial questions about whether the DFO has sufficient financial and material resources to fully support diversification. As new species are introduced into the fisheries, more human and financial resources will need to be mobilized to conduct frequent evaluations, raising concerns about the sustainability of this practice.

The material challenge behind evaluation is not the only doubt lingering about the efficiency of emergent species management. Indeed, lack of scientific data also represents an lingering concern. Let's continue with the sea urchin example. When a scientific survey is conducted, researchers from the IML calculate the total biomass of sea urchins in the Saint Lawrence River. This biomass serves as the baseline for setting the TAC. However, to determine the exact size of the quota, DFO scientists must also establish an Optimal Exploitation Rate, a ratio typically set between 5 percent and 10 percent of the total biomass, informed by scientific literature. Adjustments to the TAC are made annually based on a combination of data provided by fishermen and ongoing scientific assessments.

Despite this structured process, interviews with DFO scientists in charge of conducting those evaluations reveal significant uncertainty in defining the Optimal Exploitation Rate for sea urchins, largely due to gaps in knowledge about the species' resilience to exploitation. André, a biologist involved in these assessments, noted: " Well, I'd say we're still trying to find the right exploitation rate, the optimal one. It's a very dynamic process. And, like I was saying earlier, it's expensive to run the surveys that really give us an accurate picture of the stock's condition." (Interview, André, 2021 [originally in French; translation by the author]). Benjamin, another scientist, echoed this concern: "We calculate a range, but we don't know if it's sustainable" (Interview, Benjamin, 2021 [originally in French; translation by the author]). Sea urchin fisheries in Eastern Canada are relatively new, and the models used to manage them have yet to fully account for the ecological complexities that influence these populations. With shifting environmental conditions, the exploitation of emergent species will require more robust scientific knowledge, supported by adequate resources and time, to ensure sustainable management.

As the environment continues to evolve, the ecological variables influencing emergent fisheries are constantly shifting. While scientific models provide some structure for management, they cannot fully account for the rapid and unpredictable changes driven by climate change. A tragic example comes from Nova

Scotia, where Green Sea Urchin fisheries in the early 2000s were devastated by an epidemic of paramoeba, a disease linked to warming waters (Johnson et al., 2012). This effectively ended the practice in that region. Although the colder waters of the St. Lawrence Estuary currently protect sea urchins from this disease, the water is expected to warm in the coming years (Savenkoff et al., 2017). Other risk factors—such as ocean acidification, changes in salinity, and shifting predator populations—are also beyond the control of biologists, further complicating efforts to predict and manage these fisheries.

These concerns are palpable among fishermen, who are alarmed by the changing conditions. As one fisherman, Joël, expressed: "There is much talk about ocean acidification. How resilient is Green Sea Urchin to that?.... There is also talk of surface current getting warmer. Will larval survival be as good? Will a new disease appear? Will a new predator, known or unknown, appear? There are tens of questions, but I think there are very few answers currently" (Interview, Joël, 2021 [originally in French; translation by the author]).

This underscores the critical point: while diversification into new species is becoming more common, the scientific understanding of these species is still developing, and time is limited. In the age of the Capitalocene, ecological trajectories and fishermen's livelihoods are increasingly disrupted by market instabilities, climate change, and evolving scientific recommendations. DFO biologists, like André, acknowledge the difficulty of ensuring long-term sustainability under these conditions: "It is one thing when the main source of mortality is human, and you can control that source by managing the fisheries. But, when we add over more sources of mortality that are not set, that evolve through times.... Because climate change is that. Conditions will go everywhere, and there are no more balance points. Now, we are always... Conditions are always changing. If you add new mortality, we are important, such as disease, predations, physiochemical stress, salinity levels, and water temperature, which all directly impact... We need to be way more careful in how we are managing" (Interview, André, 2021 [originally in French; translation by the author]). Thus, while emergent fisheries may offer short-term insurance against the precariousness of established species, they introduce new layers of unpredictability into the ecosystem. The interconnections between species mean that the decline of one can lead to unforeseen shifts in biodiversity. The collapse of sea urchin populations in Maine in the 1990s (Ovitz & Johnson, 2019) serves as a cautionary tale, showing how the disappearance of one species can have cascading effects throughout the ecosystem (Steneck, 2013). As this example suggests, the more ecological change happens, the more it creates further instability, leaving fisheries management—based on static models—struggling to keep up with a dynamic and shifting environment.

Conclusion

Emergent fishing, I argue, is a creative way in which Canadian fishermen manage to respond to the precarity of a fishing industry whose stability is undermined by the current climate crisis and the volatility of international markets. However, the stability of these strategies, being governed by the same logics as the industry, remains vulnerable to the very problems they seek to address. As I have demonstrated with the green sea urchin case, despite significant efforts from all sides to manage the conservation of these species, doubts persist regarding their future as exploitable resources, both among fishermen and legislators. As emergent fisheries become more exploited and stabilize into permanent licenses, they become susceptible to the same specter of instability that haunts the existing industry. In this sense, one must ask whether the shift towards new and exploratory fisheries simply postpones an existing problem to the near future. It is also worth asking whom this strategy truly benefits. Do small-scale fisheries have the extensive resources necessary to pursue exploratory licenses?

That being said, the shared realization among all industry actors regarding the current state of instability, and the collective will to create sustainable fishing practices, is encouraging. The efforts of both fishermen and governmental actors in species conservation must be acknowledged. However, to secure that future, we must recognize the imperfections of existing models. Models are important; they offer tools to help manage complex datasets, but to be effective, models must simplify a reality that, in the current era, is becoming increasingly complex.

Ethnography and anthropology, as Anna Tsing, Neil Bubandt, and Andrew Matthews (2019) argue, allow us to complexify these models by highlighting the impact of their interaction with the socio-ecological environments in which they operate. By pointing out the complications of their material application, we can enrich their datasets by including the material realities of a world where data are precarious due to material resources or gaps in scientific knowledge. It also allows us to highlight the temporal limitations of these datasets in a world undergoing constant change. Without discarding models altogether, these insights allow us to complexify them, rethink their importance, and handle their data with extreme care. It is also crucial to consider how we can integrate flexibility into conservation measures, enabling fishermen to be more cautious without jeopardizing their livelihoods.

In doing so, it is also essential to rethink the very foundations of these models. While the conservation of species and the livelihood of fishermen are paramount, are the two truly dependent on one another? Is it responsible to tie fishermen's livelihoods to the number of fish dictated by a license, especially given the risks this poses to their future? Are we not perpetuating an imperial system that sees only profit in the extraction of natural resources—a critique formulated by Innis in 1929 and still relevant today? In the precariousness of the Capitalocene, can we envision a fishing industry that does not rely solely on the precise extraction of limited resources?

Ethnography also allows us to observe how industry actors have already disrupted the logic of these models and devised creative solutions to secure their futures. The Wolastoqiyik have creatively worked with local chefs and grocers to slowly foster a local market for green sea urchin, allowing them to maximize profits without increasing catch numbers. Mariculture has also been identified as a potential solution. Other research and development initiatives aim to utilize byproducts as well. These projects are promising but require resources

and time. Rethinking, alongside local fishermen, how we allocate resources seems like a solid start in establishing new variables that could help extricate us from management models that too simplistically equate profit potential with resource extraction.

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References

Abbott, J. K., Sakai, Y., & Holland, D. S. (2023). Species, space and time: A quarter century of fishers' diversification strategies on the US West Coast. *Fish and Fisheries*, *24*(1), 93–110. https://doi.org/10.1111/faf.12712

Anderson, S. C., Ward, E. J., Shelton, A. O., Adkison, M. D., Beaudreau, A. H., Brenner, R. E., Haynie, A. C., Shriver, J. C., Watson, J. T., & Williams, B. C. (2017). Benefits and risks of diversification for individual fishers. *Proceedings of the National Academy of Sciences*, *114*(40), 10797–10802. https://doi.org/10.1073/pnas.1702506114

Audier, S. (2017). *La société écologique et ses ennemis: Pour une histoire alternative de l'émancipation*. La Découverte.

Audier, S. (2022). Quelle politique de l'émancipation ? L'occasion éco-républicaine manquée de l'écologie politique. *Cités*, *92*(4), 109–126. https://doi.org/10.3917/cite.092.0109

Beaudreau, A. H., Ward, E. J., Brenner, R. E., Shelton, A. O., Watson, J. T., Womack, J. C., Anderson, S. C., Haynie, A. C., Marshall, K. N., & Williams, B. C. (2019). Thirty years of change and the future of Alaskan fisheries: Shifts in fishing participation and diversification in response to environmental, regulatory and economic pressures. *Fish and Fisheries*, *20*(4), 601–619. https://doi.org/10.1111/faf.12364

Bennett, N. J., Kaplan-Hallam, M., Augustine, G., Ban, N., Belhabib, D., Brueckner-Irwin, I., Charles, A., Couture, J., Eger, S., Fanning, L., Foley, P., Goodfellow, A. M., Greba, L., Gregr, E., Hall, D., Harper, S., Maloney, B., McIsaac, J., Ou, W., … Bailey, M. (2018). Coastal and Indigenous community access to marine resources and the ocean: A policy imperative for Canada. *Marine Policy*, *87*, 186–193. https://doi.org/10.1016/j.marpol.2017.10.023

Bestor, T. C. (with American Council of Learned Societies). (2004). *Tsukiji the fish market at the center of the world*. University of California Press.

Chakrabarty, D. (2009). The climate of history: Four theses. *Critical Inquiry*, *35*(2), 197–222. https://doi.org/10.1086/596640

Charbonnier, P. (2020). *Abondance et liberté Une histoire environnementale des idées politiques*. La Découverte.

Charest, P. (2012). L'accès des autochtones à la pêche commerciale et leur participation à sa gestion. In P. Charest, C. Girard, T. Rodon, & M. Bergeron (Eds.), *Les pêches des Premières Nations dans l'est du Québec: Innus, Malécites et Micmacs* (pp. 225–246). Les Presses de l'Université Laval.

Charles, A. T. (2001). *Sustainable fishery systems*. Blackwell Science. https://doi.org/10.1002/9780470698785

Cline, T. J., Schindler, D. E., S., & Hilborn, R. (2017). Fisheries portfolio diversification and turnover buffer Alaskan fishing communities from abrupt resource and market changes. *Nature Communications*, *8*, 14042. https://doi.org/10.1038/ncomms14042

Crutzen, P. J., & Stoermer, E. F. (2000). The "Anthropocene." In L. Robin, S. Sörlin, & P. Warde (Eds.),

The future of nature: Documents of global change (pp. 479-490). Yale University Press. https://doi.org/10.12987/9780300188479-041

Department of Fisheries and Oceans (DFO). (1985, December). *Commercial fisheries licensing policy for eastern Canada: Discussion paper (Cat. No. Fs 23-88/1986E)*. Atlantic Fisheries Service. https://waves-vagues.dfo-mpo.gc.ca/Library/40622927.pdf

Department of Fisheries and Oceans Canada (DFO). (2008). *New emerging fisheries policy*. Fisheries and Oceans Canada. https://www.dfo-mpo.gc.ca/reports-rapports/regs/efp-pnp-eng.htm

Department of Fisheries and Oceans (DFO). (2009, March 23). *A fishery decision-making framework incorporating the precautionary approach*. Fisheries and Oceans Canada. https://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/precaution-eng.htm

Department of Fisheries and Oceans (DFO). (2021, February 19). *Seafisheries landed value by province, 2019.* Fisheries and Oceans Canada. https://www.dfo-mpo.gc.ca/stats/commercial/land-debarq/sea-maritimes/s2019pv-eng.htm

Department of Fisheries and Oceans (DFO). (2022a, August 23). *Guidelines for implementing the fish stocks provisions in the Fisheries Act*. Fisheries and Oceans Canada. https://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/guidelines-lignes-directrices-eng.htm

Department of Fisheries and Oceans (DFO). (2022b, August 23). *Sustainable fisheries framework*. Fisheries and Oceans Canada. https://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/overview-cadre-eng.htm

Department of Fisheries and Oceans (DFO). (2023a, April). *Assessment of the Northern Contingent of Atlantic Mackerel (Scomber scombrus) in 2022: Science advisory report 2023/015.* https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/41111126.pdf

Department of Fisheries and Oceans (DFO). (2023b, November). *Review of the precautionary approach and assessment of northern shrimp stocks in the estuary and Gulf of St. Lawrence in 2023*. Department of Fisheries and Oceans, Québec Region. https://publications.gc.ca/site/eng/9.929834/publication.html

Department of Fisheries and Oceans (DFO). (2024a, December 5). *Commercial fisheries licensing policy For Eastern Canada*. Fisheries and Oceans Canada. https://www.dfo-mpo.gc.ca/reports-rapports/regs/licences-permis/index-eng.htm

Department of Fisheries and Oceans (DFO). (2024b). *2023 Fishers information*. Fisheries and Oceans Canada. https://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/fishers-pecheurs/fp23-eng.htm

Department of the Environment. (1976, May). *Policy for Canada's commercial fisheries*. Fisheries and Marine Service. Government of Canada. https://waves-vagues.dfo-mpo.gc.ca/Library/293.pdf

Emery, C. (1993, September). *Quota licensing in Canada's fishing industry* (BP-344E). Canada Library of Parliament. Parliamentary Research Branch. https://publications.gc.ca/Collection-R/LoPBdP/BP/bp344-e.htm

Epstein, G., Andrews, E., Armitage, D., Foley, P., Pittman, J., & Brushett, R. (2018). Human dimensions of ecosystem-based management: Lessons in managing trade-offs from the northern shrimp fishery in northern peninsula, Newfoundland. *Marine Policy*, *97*, 10–17. https://doi.org/10.1016/j.marpol.2018.08.018

Folke, C., Colding, J., & Berkes, F. (2001). Synthesis: Building resilience and adaptive capacity in social–ecological systems. In F. Berkes, J. Colding, & C. Folke (Eds.), *Navigating Social-Ecological Systems* (pp. 352–387). Cambridge University Press. https://doi.org/10.1017/CBO9780511541957.020

Galappaththi, E. K., Ford, J. D., Bennett, E. M., & Berkes, F. (2019). Climate change and community fisheries in the Arctic: A case study from Pangnirtung, Canada. *Journal of Environmental Management*, *250*, 109534–109534. https://doi.org/10.1016/j.jenvman.2019.109534

Galappaththi, E. K., Ford, J. D., Bennett, E. M., & Berkes, F. (2021). Adapting to climate change in small-scale fisheries: Insights from Indigenous communities in the global North and South. *Environmental Science & Policy*, *116*, 160–170. https://doi.org/10.1016/j.envsci.2020.11.009

Ghosh, A. (2021). *Le grand dérangement: D'autres récits à l'ère de la crise climatique* (M. Iserte & N. Haeringer, Trans.). Wildproject. http://wildproject.org/livres/le-grand-derangement

Goetting, K. (2008). *Is fisheries diversification a sustainable strategy?: The case of the Newfoundland redfish fishery* [Master's thesis, Memorial University of Newfoundland]. https://research.library.mun.ca/8842/

Gouvernement du Québec. (2018). *Portrait de l'industrie des pêches et de l'aquaculture commerciales—Gaspésie—Bas-Saint-Laurent: Évolution de 1985 à 2016*. Ministère de l'Agriculture, des Pêcheries et de l'Alimentation. https://www.mapaq.gouv.qc.ca/fr/Publications/Portrait_industrie_peches_et_aquaculture_web.pdf

Government of Canada. (2019). Fisheries Act (R.S.C., 1985, c. F-14), R.S.C., 1985, c. F-14 § (2019). https://laws-lois.justice.gc.ca/eng/acts/f-14/.

Government of Canada. (2024). Canada Gazette, part I, volume 158, number 41: Regulations amending the fishery (general) regulations. https://gazette.gc.ca/rp-pr/p1/2024/2024-10-12/html/reg1-eng.html

Haraway, D., Ishikawa, N., Gilbert, S. F., Olwig, K., Tsing, A. L., & Bubandt, N. (2016). Anthropologists are talking – About the Anthropocene. *Ethnos*, *81*(3), 535–564. https://doi.org/10.1080/00141844.2015.1105838

Howe, C. (2019). *Ecologics: Wind and power in the Anthropocene*. Duke University Press. https://doi.org/10.2307/j.ctv121013s

The Intergovernmental Panel on Climate Change (IPCC). (2022). *Climate change 2022: Impacts, adaptation, and vulnerability.* Cambridge University Press. https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FullReport.pdf

Johnson, T., Wilson, J., Cleaver, C., & Vadas, R. (2012). Social-ecological scale mismatches and the collapse of the sea urchin fishery in Maine, USA. *Ecology and Society*, *17*(2), 15. https://doi.org/10.5751/ES-04767-170215

Kasperski, S., & Holland, D. S. (2013). Income diversification and risk for fishermen. *Proceedings of the National Academy of Sciences*, *110*(6), 2076–2081. https://doi.org/10.1073/pnas.1212278110

Knox, H. (2020). *Thinking like a climate: Governing a city in times of environmental change*. Duke University Press.

Larrère, C. (2015). Anthropocène: Le nouveau grand récit. *Esprit*, *Décembre*(12), 46–55. https://doi.org/10.3917/espri.1512.0046

Larrère, C. (2018). L'écologie politique existe-t-elle? *Esprit*, *441*, 120–129. https://doi.org/10.3917/espri.1801.0119

Latour, B. (2017). *Où atterrir?: Comment s'orienter en politique*. La Découverte.

Michaux, E. (2012). Les pêches commerciales des Malécites de Viger: L'exploitation et la gestion du crabe des neiges et de la crevette nordique. In P. Charest, C. Girard, T. Rodon, & M. Bergeron (Eds.), *Les pêches des Premières Nations dans l'est du Québec: Innus, Malécites et Micmacs* (pp. 305–332). Les Presses de l'Université Laval.

Moore, J. W. (2015). *Capitalism in the web of life: Ecology and the accumulation of capital* (1st Edition.). Verso.

Moore, J. W. (2017). The Capitalocene, Part I: On the nature and origins of our ecological crisis. *The Journal of Peasant Studies*, *44*(3), 594–630. https://doi.org/10.1080/03066150.2016.1235036

Moore, J. W. (2018). The Capitalocene Part II: Accumulation by appropriation and the centrality of unpaid work/energy. *The Journal of Peasant Studies*, *45*(2), 237–279. https://doi.org/10.1080/03066150.2016.1272587

Morgan, R., Lesueur, M., & Henichart, L.-M. (2014). Fisheries diversification: A case study of French and English fishers in the channel. In J. Urquhart, T. G. Acott, D. Symes, & M. Zhao (Eds.), *Social Issues in Sustainable Fisheries Management* (pp. 165–182). Springer Netherlands. https://doi.org/10.1007/978-94-007-7911-2_9

Morse, N. H. (2014). *Statistiques historiques du Canada: Section N: Pêches*. Statistique Canada. https://www150.statcan.gc.ca/n1/pub/11-516-x/sectionn/4057755-fra.htm

Oreskes, N. (2010). My facts are better than your facts: Spreading good news about global warming. In P. Howlett & M. S. Morgan (Eds.), *How well do facts travel?* (pp. 136–166). Cambridge University Press. https://doi.org/10.1017/CBO9780511762154.008

Ouchi, S., Wilson, L., Wabnitz, C. C. C., Golden, C. D., Beaudreau, A. H., Kenny, T.-A., Singh, G. G., Cheung, W. W. L., Chan, H. M., & Salomon, A. K. (2022). Opposing trends in fisheries portfolio diversity at harvester and community scales signal opportunities for adaptation. *FACETS*, *7*, 1385–1410. https://doi.org/10.1139/facets-2022-0048

Ovitz, K., & Johnson, T. (2019). Seeking sustainability: Employing Ostrom's SESF to explore spatial fit in Maine's

sea urchin fishery. *International Journal of the Commons*, *13*(1), Article 1. https://doi.org/10.18352/ijc.866

Pinkerton, E., & Davis, R. (2015). Neoliberalism and the politics of enclosure in North American small-scale fisheries. *Marine Policy*, *61*, 303–312. https://doi.org/10.1016/j.marpol.2015.03.025

R. *v*. Marshall, (1999) 3 RCS 456. https://scc-csc.lexum.com/scc-csc/scc-csc/fr/item/1739/index.do

Rademacher, A. (2015). Urban political ecology. *Annual Review of Anthropology*, *44*(1), 137–152. https://doi.org/10.1146/annurev-anthro-102214-014208

Rosa, H. (2010). *Accélération: Une critique sociale du temps*. Découverte.

Roscher, M. B., Eriksson, H., Harohau, D., Mauli, S., Kaltavara, J., Boonstra, W. J., & van der Ploeg, J. (2022). Unpacking pathways to diversified livelihoods from projects in Pacific Island coastal fisheries. *Ambio*, *51*(10), 2107–2117. https://doi.org/10.1007/s13280-022-01727-x

Ross-Tremblay, P. (2019). *Thou shalt forget: Indigenous sovereignty, resistance and the production of cultural oblivion in Canada*. Institute of Commonwealth Studies.

Savenkoff, C., Gagné, J. A., Gilbert, M., Castonguay, M., Chabot, D., Chassé, J., Comtois, S., Dutil, J.-D., Galbraith, P. S., Gosselin, J.-F., Grégoire, F., Larocque, R., Larouche, P., Lavoie, D., Lebeuf, M., Lesage, V., Maps, F., McQuinn, I. H., Mosnier, A., & Nozères, C. (2017). Le concept d'approche écosystémique appliqué à l'estuaire maritime du Saint-Laurent (Canada). *Environmental Reviews*, *25*(1), 26–96. https://doi.org/10.1139/er-2015-0083

Schwoerer, T., Berry, K., Dugan, D. G., Finnoff, D. C., Mayo, M., Ohlberger, J., & Ward, E. J. (2023). Fish or not fish—Fisheries participation and harvest diversification under economic and ecological change. *Marine Policy*, *157*, 105833. https://doi.org/10.1016/j.marpol.2023.105833

Sonu, S. C. (2017). *Sea urchin supply, demand and market of Japan.* National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum, US Department of Commerce. https://media.fisheries.noaa.gov/2020-09/00-Sea-urchin-Reports-Final-Nov-8-2018-2019.pdf

Steneck, R. S., Leland, A., McNaught, D. C., & Vavrinec, J. (2013). Ecosystem flips, locks, and feedbacks: The lasting effects of fisheries on Maine's kelp forest ecosystem. *Bulletin of Marine Science*, *89*(1), 31–55. https://doi.org/10.5343/bms.2011.1148

Sun, J., & Chiang, F.-S. (2015). Use and exploitation of sea urchins. In N. P. Brown & S. D. Eddy, *Echinoderm Aquaculture* (pp. 25–45). John Wiley & Sons, Inc.

Teh, L. S. L., Cheung, W. W. L., & Sumaila, U. R. (2017). Scenarios for investigating the future of Canada's oceans and marine fisheries under environmental and socioeconomic change. *Regional Environmental Change*, *17*(3), 619–633. https://doi.org/10.1007/s10113-016-1081-5

Todd, Z. (2018). Refracting the state through human-fish relations. *Decolonization: Indigeneity, Education & Society*, *7*(1), Article 1.

Tsing, A. L. (2015). *The mushroom at the end of the world: On the possibility of life in capitalist ruins*. Princeton University Press.

Tsing, A. L. (2018). Holocene resurgence against anthropocene plantation. *Multitudes*, *72*(3), 77–85.

Tsing, A. L., Mathews, A. S., & Bubandt, N. (2019). Patchy Anthropocene: Landscape structure, multispecies history, and the retooling of anthropology. *Current Anthropology*, *60*(S20), S186–S197. https://doi.org/10.1086/703391

Vivien, F.-D. (2001). Histoire d'un mot, histoire d'une idée: Le développement durable à l'épreuve du temps. In M. Jolivet (Ed.), *Le développement durable. De l'utopie au concept: De nouveaux chantiers pour la recherche* (pp. 19–60). Elsevier.