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Fishing safely during COVID-19 in Newfoundland and Labrador, Canada: Making it happen

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ARTICLE INFO

Keywords:
COVID-19 response
Small-scale fisheries
Canada
Fish harvester perceptions of risk

ABSTRACT

Globally, fisheries have been the site of multiple documented outbreaks of COVID-19. Existing studies point to the threat posed by the pandemic to livelihoods and health among migrant industrial fishery workers, small-scale fish harvesters, and fishing communities. They show the pandemic enhanced safety, economic, social and political layers of vulnerability in fisheries, while also showcasing examples of resilience. Case studies of COVID-19 response provide an opportunity to explore how existing organizational structures, leadership and networks in fisheries can enable the rapid co-development of customized strategies for fishing safely during large-scale global disruptions such as pandemics. This article contributes to our understanding of governance and fishing safety in small-scale fisheries during the early pandemic, examining the response of small-scale fisheries in the Canadian province of Newfoundland and Labrador. These seasonal fisheries successfully opened with regulator approval after a short delay and operated without documented COVID-19 outbreaks during 2020. Findings draw from key informant interviews with a safety sector association and union leader, complemented with insights from an anonymous online survey of small-scale harvesters. Interviews capture the organizational processes and resources mobilized to rapidly co-develop the COVID-19 Safe Work Practice Guideline. Online survey findings indicate that fifty-nine percent of respondents (crew and skippers) had no COVID-19-related concerns while fishing in 2020; older harvesters and owner-operators were significantly more likely to indicate concerns. When asked about the relative practicality of listed COVID-19 precautions, respondents commonly identified sanitation, reduced interactions with shore workers, social distancing, protection equipment, modifications to eating/rest areas, and reduced crew as impractical. These assessments are generally consistent with those of the interviewed leaders and the Guideline approach. This suggests the co-developed Guideline provided tailored and practical COVID-19 prevention strategies. Pre-existing governance structures and networks can help address small-scale fisheries vulnerabilities to pandemics by supporting co-development of organizational resources and evidence-informed prevention strategies.

1. Introduction

On March 11, 2020, the World Health Organization declared COVID-19 a global pandemic. In the months following, fish harvesting in some countries was stopped, reduced, or delayed due to safety concerns, shipping/transport cancellations and closures of global markets [1]. Regular early reports in the international media and elsewhere highlighted the impact of the pandemic on the fisheries and aquaculture sectors, including on prices, incomes, food security, safety, and vulnerability to infection (see for example, [2,1,3,4] SAMUDRA News Alerts n. d.; [5]). By the summer of 2021 the global health community had much better understanding of the COVID-19 virus, how it is spread, and how to control that spread; access to vaccines was also becoming widespread – particularly in the global North. This evolving challenge has prompted a
growing body of research on pandemic impacts across diverse fisheries and groups of fisheries workers, including exploration of related vulnerabilities and sources of resilience (see, for example, [6-11]). This article contributes to this research and to our knowledge of governance and fishing safety more generally by presenting a case study highlighting rapid adoption of a COVID response for small-scale fisheries in the province of Newfoundland and Labrador on Canada’s east coast, co-developed with small-scale harvesters.

Commercial fishing in Newfoundland and Labrador provides employment for thousands of harvesters, processing workers, truckers and others throughout the supply chain and plays a critical role in rural coastal economies in the province. In 2015, approximately 10,000 individuals reported income from fishing on their tax returns [12]. Roughly nine-tenths were employed in small-scale fisheries (vessels < 65 feet) which encompass seasonal, owner-operated inshore or near-shore fishing enterprises; the remainder were employed by vertically integrated companies in primarily offshore fisheries. Most small-scale fishing enterprises (our focus here) are family-owned and based in small, rural and remote coastal communities with limited access to health care. In contrast to fish processing in other parts of Atlantic Canada and many industrial fisheries (e.g. Alaska; Asia), where fisheries labour forces employ more precariously employed internally and internationally migrant workers [13,8,14,15], in Newfoundland and Labrador, most harvesters and other fishing industry workers are Canadian citizens and provincial residents. Unionization rates are also uncharacteristically high, with one union encompassing owner-operators and crew members, as well as some offshore harvesters and seafood processing workers. In addition, the province has a multi-stakeholder fish harvesting safety sector association that works closely with the union, safety regulators, and other agencies.

1.1. COVID-19 and fishing safety: the wider context

Research indicates risk of COVID-19 infection in fishing during the early period of the pandemic was mediated by pre-existing, variable, and interacting safety, economic, social and political vulnerabilities. At this time, and as will likely be the case for the onset of new pandemics in the future, minimizing mobility outside of the home was the main containment strategy but was not feasible for essential sectors like food production and posed a major threat to livelihoods in seasonal small-scale fisheries. In the absence of testing and vaccines, and with evolving but limited knowledge of symptoms, the main prevention tools available for those going to work focused on reducing the risk of viral exposure through monitoring, exclusion of those with symptoms, physical distancing, and access to and use of personal protection equipment (PPE). Documented outbreaks in workplaces including in food processing, fishing and seafood processing reflect the limited effectiveness of such solutions (e.g. [4]).

Safety risks from pandemics like COVID-19 are exacerbated by such inherent features of fishing as: a) mobility of crews to and within work and interactions with shore crew during offloading, which presents opportunities for infection; b) frequently crowded working and living conditions onboard vessels, complicating adherence to physical distancing guidelines; c) limited ventilation in fishing vessel holds and sleeping quarters; d) potentially constrained resources in fishing communities for pandemic education, communication and for monitoring safety practices by health and safety and public health authorities; and, e) limited access to health care during prolonged periods at sea, and in remote communities.

As documented for other health and safety issues, precise constellations of COVID-19 layers of vulnerability [16] and their effects vary across fisheries, as do sources and patterns of resilience [9]. For instance, industrial offshore fishery workers in parts of the global South already at increased risk for violations of labour and human rights and injury, found these enhanced during COVID-19 [7,8,11]. Travel restrictions and constrained access to health care enhanced existing economic, social and health risks for these workers [7] with the latter further exacerbated by limited access to basic information about the virus (e.g. spread; effective safety measures). Underlying these risks are social and political (i.e. governance) structural vulnerabilities related to lack of regulation, unionization, conditions in their home countries and other factors [11]. Fishery workers in the Global North are not immune to these vulnerabilities with workers (onshore and offshore on factory trawlers), including particularly migrant and racialized workers in Alaska estimated to have been at elevated risk of infection during 2020–2021 [17].

The constellations of vulnerabilities for small-scale harvesters (our focus here), are also multi-layered. These fisheries involve millions of harvesters globally, with varying types and degrees of vulnerability [6]. Vessels employed are generally small and cramped, creating unique challenges for reducing on-board spread of infection while crews work, sleep, and eat in close quarters; some vessels must also accommodate observers or scientists [10]. Small-scale fishing vessels enter and leave ports more frequently than industrial vessels, bringing crew in contact with potential infections. However, they are also more likely to fish locally with smaller crews than industrial fisheries, limiting risk of infectious contacts as well as the potential size of on-vessel outbreaks. In small-scale fisheries owned and crewed by family and community members, vulnerabilities are more likely to include the potential for infection spreading between potentially large numbers of vessels as well as back and forth between vessels, fishing households, communities, and ports. This is a vulnerability, but it is also a potential source of resilience in small-scale fisheries because of the potential role of family ties and community concerns in supporting activities designed to limit risk.

Economic vulnerabilities in small-scale fisheries include the risk of missing seasonal fisheries and related pressures to fish to feed their families, pay for their enterprises, and service related debt, which must be balanced against risk of infection. Sorensen et al. (2020) study of COVID-19’s influence on commercial fisheries workers in the Northeast US shows the economic impact was swift and severe. They note that some fish harvesters chose direct marketing of their catch due to the effects of COVID-19 on traditional markets, resulting in longer hours and fear of infection while dealing with the public. Some reduced crew size to cut costs (with potential implications for safety); some decided to fish with family members to reduce possible points of COVID-19 infection. Other economic vulnerabilities include difficulties purchasing affordable PPE, modifying vessels for physical distancing, and accessing health care or testing (particularly in remote areas, or the absence of health insurance).

Effective governance of small-scale fisheries is challenging [18], including fishing safety [19]. This is particularly the case where they employ large numbers, are geographically dispersed, and have limited regulatory oversight and unions and other organizations responsible for worker safety. This is illustrated, in the case of COVID-19, by results from an online survey of Alaska fishermen, family members and some industry workers regarding early effects (spring 2020; n = 779). The survey found respondents were mainly concerned about loss of income, closely followed by preventing disease spread in coastal communities [20]. A majority wanted fisheries to remain open with health and safety measures in place. Many wanted local governments to provide “clear and understandable guidelines for following local health mandates”, and about half wanted information about COVID-19 health and safety. Less than half of the survey respondents were represented by an advocacy organization.

In their recommendations for action in small-scale fisheries, Bennett et al. [6] call on actors at multiple levels to take steps assisting the COVID-19 pandemic response. These actors include governments, nongovernmental organizations, donors, the private sector and researchers. Sorensen et al. [10] highlight the need for “tailored, practical COVID-19 prevention strategies for the worksite” including guidance on appropriate PPE; on-vessel COVID-19 testing; and quarantining should harvesters become ill at sea (p. 390). A key question is under what
circumstances these kinds of interventions are likely to happen, and what consequences exist for fishing safety? The remainder of this paper addresses this question, presenting findings from a case study of the COVID-19 safety response in small-scale fisheries in Newfoundland and Labrador, Canada during the first year of the pandemic.

1.2. COVID-19 and the NL Commercial Fisheries: The Local Context

COVID-19 was designated a global pandemic just a few weeks prior to the scheduled opening of the seasonal small-scale NL fisheries. The provincial Chief Medical Officer of Health announced the first presumptive case of COVID-19 on March 14, subsequently declaring a public emergency on March 18 [21,22]. Most government offices were closed along with many businesses and services, requiring work from home where feasible. Eventually, the provincial government mandated the use of masks in public venues and workplaces deemed ‘essential,’ but where physical distancing was challenging. All but essential travel into the province, including from other Canadian provinces, was tightly controlled and almost all entrants (such as returning interprovincial or ‘rotational’ workers) were required to self-isolate for 14 days following entry. Public Health also imposed limits on the number of regular personal contacts for residents to small ‘bubbles’; initially limited to a single household, bubble size was later adjusted depending on the number of cases. These measures allowed the province to bring down infections in spring 2020 and largely prevent community spread over the next several months, enabling gradual expansions to gathering sizes and re-opening of parts of the economy. Another major outbreak occurred in February 2021, as part of the second wave of COVID-19 associated with the appearance of one of the newer variants. This triggered another lock-down of schools and businesses, lasting several weeks (COVID-19 Pandemic in Newfoundland and Labrador, 2021). This coincided with administration of the on-line survey discussed below, and occurred shortly before the scheduled re-opening of the seasonal small-scale fisheries in spring 2021. Starting in late spring 2021, public health and the Newfoundland and Labrador provincial government launched free mass vaccination programs with priority given to health care workers and the elderly; fish harvesters would not have been eligible until later in 2021.

2. Methods

2.1. Interviews

Semi-structured, recorded key informant interviews with two leaders of the Newfoundland and Labrador COVID-19 small-scale fisheries response and a review of key documents were used to reconstruct activities and processes associated with COVID response development for small-scale fisheries in Spring 2020.

2.2. Survey

Results from an anonymous quantitative survey with some open-ended questions are also included in the findings. Co-designed by the co-authors, the survey was approved by Memorial University’s Interdisciplinary Committee on Ethics in Human Research and administered using the on-line survey program Qualtrics. Survey invitations were distributed by the Fish Food and Allied Workers union in Newfoundland and Labrador, along with other organizations in New Brunswick, Nova Scotia and Prince Edward Island; responses were collected between February and March 2021. The survey had 35 questions covering respondent demographics (age, gender, etc.), fishing activities in 2020 (vessels, gear, primary and secondary species fished), COVID-19 related concerns while fishing (about safety, crew safety and family’s safety related to fishing during COVID), assessment of the practicality of safety measures, and information on COVID-19’s potential influence on other fishing safety concerns.

Fish harvesters tend to have licenses for several species, employing different crew and vessel sizes depending on the species they harvest. Some fisheries (such as crab versus lobster) are more likely to require overnight and multi-day trips. The survey requests information about fish harvesters’ primary (main) and secondary species, as there may be differences in type of boat and number of crew and the need for overnight accommodations between these two species. Surveys where at least 80% of the questions were completed were deemed ‘usable’ (244); 196 (80%) were returned by owner-operators and crew from Newfoundland and Labrador small-scale fisheries who had fished between February and September of 2020.

We used chi-square statistics to conduct bivariate analyses testing relationships between participants’ COVID-19 concerns and i) participant characteristics and ii) perceived practicality of COVID-19 measures. Relationships with p-values < 0.05 were considered significant. STATA 14 was used to clean and analyze data. This paper uses the Newfoundland and Labrador data only (see supplementary material for a copy of the relevant survey instrument and supplementary tables containing descriptive statistics of answers to the survey).

3. Results

3.1. Fishing safely during COVID-19: responding to the challenge

This section presents findings from interviews conducted with two key people involved in the industry-led pandemic response who are also co-authors of this manuscript: Brenda Greenslade of the Newfoundland and Labrador Fish Harvesting Safety Association (the Safety Association) and David Decker of the Fish Food and Allied Workers union (the Union) representing Newfoundland and Labrador’s small-scale fish harvesters and chair of the board of the safety association. The interviews were conducted in winter 2021. The Safety Association is a not-for-profit, industry-led safety sector association established in 2012 that is dedicated to injury prevention. Its Board of Directors and Advisory Committee are comprised of fish harvesting industry experts representing the main agencies involved in fishing safety in Newfoundland and Labrador (https://www.nlfsa.ca/). The Union represents all Newfoundland and Labrador harvesters, and many seafood processing workers. The union and the safety association work with all fishing fleet sectors, but we limit our discussion to their small-scale fisheries (vessels < 65 feet) initiatives and COVID-related initiatives.

Key informants recall that most fish harvesters wanted to fish in spring of 2020, albeit safely and without risk to themselves, their families, or their communities. Despite pressure from some to open fisheries on schedule, there was a strong consensus among regulators and industry organizations that fish harvesting and processing could not proceed until safety could be ensured. The big question was “can you fish safely during a pandemic and if so, how?” To operate in the spring of 2020, the industry was required to have COVID-19 safety protocols in place. While there was general guidance around protocols from Public Health and the Occupational Health branch of government, guidance was not necessarily appropriate for small-scale fisheries. Key challenges were: i) to rapidly develop a safe work guideline addressing COVID-19 transmission that were practical and effective across vessel types and fisheries, and accommodated industry constraints; and ii) to disseminate the guideline to owner-operators and others in the industry in an effective, timely fashion.

Greenslade had worked as a registered nurse in both community health and occupational health prior to joining the Safety Association, giving her a unique combination of knowledge, experience and contacts essential for anticipating the effects of a pandemic and working to devise an infection control strategy appropriate for fisheries. She was in regular communication with Decker at the Union prior to COVID-19’s arrival in the province, consistently stressing that “this is serious business and we have to get on top of it.” The two leaders activated the network of volunteer Union committees, including the Inshore Council representing
NL’s small-scale harvesters, along with members of the Association’s Board of Directors. This network conducted weekly meetings to consult, discuss and build consensus on paths forward. These joint efforts were critical to the rapid co-development of a comprehensive Communicable Disease Briefing COVID-19 Safe Work Practice guideline (the Guideline) for fish harvesters (see supplementary material).

The Safety Association released the Guideline on April 19, 2020, and small-scale crab fisheries subsequently opened May 11th. The Guideline stressed that the risk of exposure and need for containment were greatest during pre-departure screening, loading and unloading, food handling, sleeping aboard vessels, and emergency responses to fishing health and safety incidents. Consistent with health and safety law in Newfoundland and Labrador, the Guideline placed strong emphasis on the role of the owner-operator or skipper in managing safety on the vessel and among crew. It also emphasized limiting bubble size to family and crew, an approach consistent with the province’s public health requirements during outbreaks. The Safety Association developed a graphic (Supplementary Figure 1) to illustrate their recommendation for fish harvesters to have two bubbles: one at home and another consisting of the work crew. This bubble approach was considered particularly manageable for the many family-owned and operated fishing enterprises, as family members would comprise the core group of both bubbles. Furthermore, even when crew members are not related, they often have long histories working together and consider themselves family. Pandemic planning did, however, bring attention to exceptions, e.g. cases where crew included transient workers employed on several vessels during a season, requiring regular travel between home and work. In these cases, it would be impossible to keep crew bubbles intact, forcing skippers to rely more on self-reporting of symptoms and contacts and screening prior to boarding the vessel.

In developing the Guideline, Greenslade indicates the Safety Association had to navigate “between community health and occupational health and safety regulators [while] paying close attention to the recommendations that were coming forward [and] … listening to the issues and concerns from fish harvesters.” They had to do this during a period when “the information about COVID was evolving and appropriate measures to control the disease were changing, often daily, and sometimes the information was confusing and conflicting.” One of the biggest concerns from a regulatory perspective was the provincial masking requirement. While OHS regulators recommended N95 respirators, availability was limited; alternatives (e.g. paper surgical masks) could not withstand wind and sea spray. Addressing this issue involved ongoing communication with the Chief Medical Officer and health and safety regulators, who Greenslade described as ‘exceptional in their respect for the concerns of fish harvesters and providing support for the industry.’ It was decided that, at that time, cloth masks were the most practical for harvesters, could be made locally, and were easily available; these ultimately became the accepted standard for 2020.

Fish harvesters raised concerns about physical distancing requirements on some vessels as captured by a fisherman’s comment, referenced by interviewees and repeated by media: “We sleep so close together we share the same dreams” (Garrett, 2020). In the end, while acknowledging the challenges, the Safety Association kept physical distancing recommendations in the Guideline. While leadership recognized that it would not be feasible to implement every best practice on every fishing vessel, they felt fish harvesters would apply what they could to ensure the safest work environment for themselves and fellow crew.

Additional challenges involved managing potential exposures when offloading at wharves. The original plan was to have all the harvesters remain on vessels while off-loading crews removed fish; however, some off-loading crews refused to do this, leaving harvesters to offload fish themselves. Potential crew exposures from dockside monitors going into vessel holds to check reported catch were averted when monitoring requirements were lifted. A final issue was potential exposures from community members gathering on wharves; fortunately pandemic rules limiting the size of public gatherings, requiring physical distancing, and maintaining bubbles helped to address this exposure risk.

When asked what might have happened if the Safety Association and the Union had not taken the lead in developing a strategy and Guideline for responding to the combined health and economic threat posed by COVID-19, Greenslade commented:

“The Newfoundland and Labrador Fish Harvesting Safety Association had the assurance of the leadership in the union, as well as constructive and critical feedback from fish harvesters … [who] had the opportunity to say what they liked about the safe work practice, what they didn’t like, and what they thought was practical or impossible to do. Sometimes the criticism was harsh, but there were a lot of unknowns and this was a new, world-wide threat that people were experiencing. Fish harvesters were concerned about their own well-being and that of their families and crew members, as well as their livelihood. It was a stressful time and while they knew fishing, fishing during a pandemic was a whole new experience.”

Decker commented on the “vigorous debates” they had on their regular calls with fish harvesters from all sectors and regions of the province. He noted that in the absence of their organized intervention there would have been “… a lot of animosity between different groups… I think you would have seen individual confrontations in terms of communities that tried to start up an industry when people didn’t think it was safe to do so.”

Most Canadian provinces with coastal waters have a fishing safety association; as COVID-19 began moving across Canada, Newfoundland and Labrador’s Safety Association contacted all other associations to share experiences and resources. Some other associations used their Guideline to inform their own approaches.

### 3.2. Findings from an on-line survey of Newfoundland and Labrador small-scale fish harvesters

Prior to the opening of the 2021 seasonal fisheries, the co-authors administered an anonymous, online survey of fish harvesters’ perspectives on COVID-related concerns and precautions during the 2020 fishing season. The survey was designed to capture variability related to the physical infrastructure to which fish harvesters were exposed in their work, as well as fish harvesters’ perceptions regarding the practicality of safety measures and related concerns. Responses were received from 196 Newfoundland and Labrador harvesters. Respondents were primarily male (78.5 %, n = 153) and mainly owner-operators (59.2 %, n = 116), rather than crew. Some respondents worked both as crew and owner-operators during the season; in these instances, respondents were classified as owner-operators. About half of respondents (54 %) were 50 years of age or older and very few were younger than 30 years (7 %, n = 14) (Table 1). Survey participants were on average younger than the population of registered fish harvesters in the province. Data obtained from the Professional Fish Harvester Certification Board shows that 63

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**Table 1**

| Characteristics of survey participants. | Crew members | Owner-operators | Total |
|---------------------------------------|--------------|----------------|-------|
| **Gender**                            |              |                |       |
| Men                                   | 50 (62.5)    | 103 (89.57)    | 153 (78.46) |
| Women                                 | 30 (37.5)    | 12 (10.43)     | 42 (21.54)  |
| **Age**                               |              |                |       |
| < 30                                   | 10 (12.5)    | 4 (3.56)       | 14 (7.14)  |
| 30–39                                 | 27 (33.75)   | 9 (7.76)       | 36 (18.37) |
| 40–49                                 | 15 (18.75)   | 25 (21.55)     | 40 (20.41) |
| > 50                                  | 18 (22.5)    | 42 (36.21)     | 60 (30.61) |
| **Fished a second species**           |              |                |       |
| Yes                                   | 42 (53.16)   | 76 (65.52)     | 118 (60.51) |
| No                                    | 37 (46.84)   | 40 (34.48)     | 77 (39.49) |
| **Total**                             | 80 (100)     | 116 (100)      | 196 (100)  |
% of registered fish harvesters are above age 50 while in this study’s sample 54 % were older than 50.

Fifty-nine percent (n = 116) of provincial respondents reported having no COVID-19-related concerns while fishing in 2020 (Table 2). Respondents who did indicate concerns while fishing were significantly more likely to be older (66 % of people who expressed having COVID-related concerns when fishing their primary species or both species were 50 years of age and older, p-value<0.05), and were significantly more likely to be owner-operators (70 % of those with COVID-related concerns were owner-operators and only 30 % were crew, p-value<0.05) (see Table 2). No relationship was identified between concerns and duration of fishing trip; length of vessel; whether the vessel was decked/undecked; or whether it had sleeping accommodations (all p-values>0.05).

Responses to an open-ended question about concerns mainly addressed physical contact; physical distancing; and interactions between bubbles. Some respondents found it difficult to practice physical distancing on their vessels and with onshore workers (mostly buyers) and were concerned about expanded bubbles (n = 62), for example, crew members working in several vessels and contact with family members not working on the fishing vessel. Only a few mentioned difficulties accessing PPE (2); difficulties wearing PPE (n = 3); lack of information about the virus (n = 1); and lack of sanitization precautions (n = 2).

Respondents to the structured question “How practical were COVID-19 safety precautions for you to implement while fishing the species you spent the most time fishing in 2020?” were most likely to identify the following as practical: enhanced/additional sanitization; reduced interactions with shore workers; and crew/vessel bubbles. They were more likely to select social distancing during fishing operations, use of PPE, modifications to eating/rest areas, and reduced crew as impractical (See Fig. 1).

However, there were significant differences in the perceived practicality of some COVID-19 safety precautions between respondents who had COVID-related safety concerns while fishing and those who did not (Table 3). The differences were stronger for ‘forming a crew/vessel bubble’, ‘social distancing during fishing’, and ‘reduced interaction with shore workers’ (p-value<0.001).

4. Discussion

There were economic, social and food security reasons for fisheries to continue to operate in March of 2020, but it was not clear how to do this safely at the beginning of the pandemic and in a way that would garner the approval of public health and workplace safety regulators. These concerns were amplified by the challenges of limiting contact on small vessels, the timing of the pandemic onset with the start of the year’s fisheries with strong economic pressures to open on time, as well as by the large number of harvesters involved and their geographical dispersal, and by limited access to healthcare in the rural/remote communities where many NL harvesters live. Following a relatively short delay, these small-scale fisheries operated near full capacity in 2020 while avoiding outbreaks and related shutdowns. Several factors appear to have contributed to the resilience of the fishery to the combined safety, economic and social threats (including the threat of community-level conflict) of the early stages of the pandemic.

Despite the challenges, from a governance perspective, managing the pandemic threat to safety was likely easier for small-scale Newfoundland and Labrador fisheries relative to those elsewhere. A key factor appears to have been the success of provincial-level initiatives to track and contain infections in the wider community. Prompted by a major outbreak in March 2020, the Chief Medical Officer of Health launched a rapid and multi-faceted intervention with the support of the provincial government that limited overall infection levels and reduced risk of infection during much of the first year of COVID-19. While mobility within Canada is constitutionally protected, based on public health priorities, Newfoundland and Labrador was able to manage entry into the province by excluding nonresidents and implementing requirements for quarantining upon arrival (as well as for residents displaying symptoms or with likely exposure). The relative isolation of the province with limited points of entry that could be monitored by government was an advantage for this part of the strategy. In contrast to other regions and industries (e.g. agriculture), the Newfoundland and Labrador fisheries also benefited from limited reliance on international migrant workers, despite quarantine requirements, were subject to multiple, major outbreaks in other Canadian provinces [4]. The benefits of this larger provincial ‘bubble’ of protection were supplemented in fisheries by the sector-level mobilization outlined in this article.

As elsewhere, Newfoundland and Labrador’s small-scale fisheries are comprised of thousands of dispersed small- to medium-sized enterprises. It is well recognized that injury and illness prevention in such enterprises is challenging, requiring “something more than a readily prepared template to complete a safety management system aligned to their business” [23], p. 168). In this context, governance structures and experienced and longstanding leadership personnel in existing fishing industry associations are key to addressing the multiple layers of vulnerability associated with large-scale disruptions. In the case of Newfoundland and Labrador, the multi-stakeholder Safety Association and the Union provided the means to quickly mobilize existing organizational expertise, resources and networks in response to the pandemic threat. This led to a delayed opening of seasonal fisheries (supported by the Federal Department of Fisheries and Oceans), despite their substantial economic importance and opposition from some. A relatively short delay coupled with reliance on existing organizational resources, expertise, communications and consultation processes allowed for the
development and dissemination of a safe-work Guideline, based on extensive input from fish harvesters and consultation with public and occupational health regulators. Building on the recommended findings from other studies of COVID-19 and fisheries where this did not always happen, the Guideline drew on emerging knowledge and generic public and occupational health tools, fine-tuned for the realities and needs of the industry [6,10].

As indicated by our key informants and confirmed by findings from an anonymous online survey, Newfoundland and Labrador small-scale fisheries are diverse in terms of species fished, vessel design, crew composition, and trip duration (see Supplementary Tables). Some fish alone or in family or nonfamily enterprises with stable crew and family-like relationships. Using their family/crew bubbles to limit exposures at work and away from work was consistent with key elements in the larger public health strategy for managing COVID-19 in the province and was relatively practical for many, but not all harvesters. As the key informants discovered in discussions around the Guideline, some skippers rely on more transient ‘out-of-bubble’ crew. Furthermore, some harvesters are interprovincial workers who reside in the province but work elsewhere for part of the year [12]. As acknowledged by the leadership and indicated in responses to the online survey (see Table 2), the Guideline needed to encompass the diversity in crewing arrangements, as well as wider public health and occupational health regulatory requirements. The latter included achieving an appropriate degree of compliance with the provincial health and safety act, including widespread reliance on screening, masking, physical distancing and sanitation common to generic COVID-19 workplace protocols. The Guideline relied, where possible, on the formation of family and crew bubbles during the season, while limiting contacts with those on shore; however, the leadership recognized this approach had constraints. As part of this compromise and consistent with the province’s health and safety act, it placed the onus on skippers (often owner-operators), to spearhead the development, implementation, and monitoring of COVID-19 protocols appropriate for their situation.

Findings from the online survey indicate most felt safe while fishing in 2020, with those at greater risk of serious COVID-19 illness and bearing responsibility for overall fishing safety, namely older fish harvesters and owner-operators, most likely to express concerns. A surprising finding is that physical infrastructure of vessels and working conditions (length, decked/undecked, sleeping accommodations, duration of fishing trips) did not influence COVID-19 concerns among respondents. These findings may point to the realities of small-scale fishing work, which requires work in close quarters irrespective of differences in design or work organization. Survey respondents’ assessments of the practicality of different COVID-19 interventions are variable but largely consistent with messages key informants received during the Guideline consultation process. Precautions deemed practical by survey respondents, such as enhanced sanitization and reduced interactions with shore workers, are somewhat easier to implement in fish harvesting than those deemed impractical (social distancing; modifications to eating and rest areas; use of PPE). That said, interactions with shore crew would have been affected not only by harvester actions but also by the actions of those workers and their employers. The small size of fishing vessels in this part of the fleet (boats < 65 feet with most much smaller) and cramped working, eating, and sleeping spaces on decked vessels would impede distancing while on board, and constrain options for meaningful modifications for physical distancing. The damp, windy work environment and, particularly during the 2020 season, limited access to masks could explain assessments of the impracticality of PPE. The fact that fish harvesters who had COVID-19 related concerns found more safety precautions impractical than people without concerns (Table 3) could point to several factors that we were not able to capture with the survey. However, we could infer that impractical precautions may be more difficult to achieve, with unfeasible precautions raising overall COVID-19 concerns.

Owner-operators’ significantly greater concerns regarding pandemic fishing safety and practicality of some measures likely reflect both their ambivalence about the legislative and Guideline emphasis on their OHS responsibilities, particularly in the early pandemic when evolving COVID-19 information and limited testing options left owner-operators reliant mainly on symptom self-reports. With COVID-19, behaviours beyond the workplace (outside the scope of normal manager/skipper responsibilities) could result in crew member infections. They could be asymptomatic when reporting to work or fail to report symptoms when boarding the boat (out of economic need or fear of repercussions) and infect others on board. These challenges would have been greater when dealing with transient and mobile crew members.

There were some limitations with the survey. Case study findings are

![Fig. 1. Number of participants according to their perceived practicality of implementation of each of the COVID-19 safety precautions listed in the survey for their primary species.](image-url)
Table 3
Practicality of COVID-19 safety precautions when fishing primary species and COVID-related safety concerns while fishing primary (or both) species in 2020.

| 1. Crew/vessel bubble | No COVID concerns n (%) | COVID concerns for primary or both species n (%) | p-value |
|-----------------------|-------------------------|--------------------------------------------------|---------|
| Practical             | 40 (50)                 | 26 (37.14)                                       | 0.001   |
| Neutral               | 25 (31.25)              | 12 (17.14)                                       |         |
| Impractical           | 15 (18.75)              | 32 (45.71)                                       |         |

| 2. Social distancing from family and friends | No COVID concerns n (%) | COVID concerns for primary or both species n (%) | p-value |
|---------------------------------------------|-------------------------|--------------------------------------------------|---------|
| Practical                                   | 30 (41.1)               | 22 (32.35)                                       | 0.014   |
| Neutral                                     | 20 (27.4)               | 9 (13.24)                                        |         |
| Impractical                                 | 23 (31.51)              | 37 (54.41)                                       |         |

| 3. Social distancing during fishing | No COVID concerns n (%) | COVID concerns for primary or both species n (%) | p-value |
|------------------------------------|-------------------------|--------------------------------------------------|---------|
| Practical                           | 26 (33.33)              | 14 (20.59)                                       | < 0.001 |
| Neutral                             | 22 (28.21)              | 3 (4.41)                                         |         |
| Impractical                         | 30 (38.46)              | 51 (75)                                          |         |

| 4. Enhanced/additional sanitization | No COVID concerns n (%) | COVID concerns for primary or both species n (%) | p-value |
|------------------------------------|-------------------------|--------------------------------------------------|---------|
| Practical                           | 49 (57.65)              | 34 (52.31)                                       | 0.088   |
| Neutral                             | 22 (25.88)              | 11 (16.92)                                       |         |
| Impractical                         | 14 (16.47)              | 20 (30.77)                                       |         |

| 5. Use of PPE | No COVID concerns n (%) | COVID concerns for primary or both species n (%) | p-value |
|---------------|-------------------------|--------------------------------------------------|---------|
| Practical     | 32 (39.51)              | 14 (20.9)                                        | 0.006   |
| Neutral       | 17 (20.99)              | 9 (13.43)                                        |         |
| Impractical   | 32 (39.51)              | 44 (65.67)                                       |         |

| 6. Modification to eating/rest area | No COVID concerns n (%) | COVID concerns for primary or both species n (%) | p-value |
|------------------------------------|-------------------------|--------------------------------------------------|---------|
| Practical                           | 26 (36.11)              | 10 (16.13)                                       | 0.010   |
| Neutral                             | 14 (19.44)              | 9 (14.52)                                        |         |
| Impractical                         | 32 (44.44)              | 43 (69.35)                                       |         |

| 7. Reduced crew | No COVID concerns n (%) | COVID concerns for primary or both species n (%) | p-value |
|-----------------|-------------------------|--------------------------------------------------|---------|
| Practical       | 13 (21.31)              | 10 (17.86)                                       | 0.890   |
| Neutral         | 13 (21.31)              | 12 (21.43)                                       |         |
| Impractical     | 35 (57.38)              | 34 (60.71)                                       |         |

| 8. Reduced interaction with shore workers | No COVID concerns n (%) | COVID concerns for primary or both species n (%) | p-value |
|------------------------------------------|-------------------------|--------------------------------------------------|---------|
| Practical                                | 56 (67.47)              | 23 (33.82)                                       | < 0.001 |
| Neutral                                  | 15 (18.07)              | 13 (19.12)                                       |         |
| Impractical                              | 12 (14.46)              | 32 (47.06)                                       |         |

| 9. Social isolation from family and friends, etc. | No COVID concerns n (%) | COVID concerns for primary or both species n (%) | p-value |
|---------------------------------------------------|-------------------------|--------------------------------------------------|---------|
| Practical                                         | 27 (37.5)               | 19 (29.69)                                       | 0.042   |
| Neutral                                           | 18 (25)                 | 8 (12.5)                                         |         |
| Impractical                                       | 27 (37.5)               | 37 (57.81)                                       |         |

| 10. Other | No COVID concerns n (%) | COVID concerns for primary or both species n (%) | p-value |
|-----------|-------------------------|--------------------------------------------------|---------|
| Practical | 8 (50)                  | 1 (10)                                           | 0.085   |
| Neutral   | 5 (31.25)               | 4 (40)                                           |         |
| Impractical| 3 (18.75)              | 5 (50)                                           |         |

informative but need to be treated with caution given the small number of interview and survey respondents, and that the survey was not based on a representative sample of registered fish harvesters in the province. Participants in this study were on average younger than registered fish harvesters in the province. The survey did not include questions regarding transient crew members and, while the survey questions and interviews focused on the 2020 season, survey data were collected in winter 2021, by which time more was known about COVID-19. Testing for those with symptoms eventually became available and was added to the arsenal of COVID-19 control requirements along with, starting slowly in March 2021 a vaccination program. In addition, the province experienced a second major COVID-19 outbreak during the survey period (February-March, 2021). These contextual factors likely influenced survey responses. Vaccines were not, however, available to industry participants until later in 2021 so despite new knowledge, realistic prevention options had not changed significantly by Spring 2021 from those found in the original Guidelines. The Safety Association used the same infection control protocols with only a few modifications for the 2021 season, based in part on the belief that consistent messaging is key to the development of awareness and adoption of safe practices for infectious disease control.

5. Conclusion

As argued above, existing research done during the first year or so of the pandemic highlighted the layers of physical, economic, social and political vulnerability that placed fishery workers and small-scale fisheries at substantial risk. These layers and the precise constellations of vulnerability to infection and illness varied within and across industrial and small-scale fisheries. While the work organization and physical infrastructure risks to infection and economic pressures to fish despite those risks are pervasive, and to some degree inherent to seasonal small-scale fisheries (particularly at lower incomes and higher debt loads), the case study presented here highlights how social organizational resources and effective governance can partially offset other vulnerabilities. As noted elsewhere, existing research indicates small-scale harvesters elsewhere wanted to fish in order to protect livelihoods but wanted clear COVID-19 safety guidance, customized for the particular challenges of this sector. Research also highlights limited access to such guidance and related gaps in organizational representation and safety expertise in many fisheries appropriate for the hazard and the sector.

As of summer 2022, NL’s small-scale fisheries are in the third year of mid-pandemic operation. Vaccination rates were high in the province overall by the end of 2021. Much of the public infrastructure around monitoring and prevention of the spread of COVID-19 was dismantled in 2022 making it very difficult to track the scale, distribution and consequences of infections beyond hospitalizations and deaths. This leaves responsibility for prevention, monitoring and management of outbreaks in workplaces to employers and worker representatives, industry organizations and regulators (should they know about them). No outbreaks connected to Newfoundland and Labrador fisheries have been documented in the media in 2022. An ongoing research project on seafood processing workers in the province that includes attention to COVID-19 impacts has, however, documented reports of multiple 2022 COVID-19 outbreaks in processing plants. Given overlaps between processing worker and harvester families, offloading activities and mingling in the wider community, there may well be undocumented COVID-19 cases among harvesters in 2022.

The ultimate consequences of COVID-19 for the health of fish harvesting and processing workers, and for the design of safety interventions around future pandemics remain key areas requiring future research. Despite its limitations, results from this case study may help inform future pandemic response in small-scale fisheries in Canada and elsewhere. It identifies the crucial role played by existing organizational structures, leadership resources, and networks in the rapid co-development and dissemination of the means to fish safely at the start of a pandemic in one small-scale fishery – particularly when supported by a strong, provincial-level infection prevention and monitoring program. This suggests that helping to address key social and political vulnerabilities in small-scale and industrial fisheries in other contexts is essential to better pandemic planning and preparation.

Data Availability

Data will be made available on request.
Declaration of Competing Interest

Two of the co-authors, Brenda Greenslade and David Decker are closely affiliated with the NL Fish Harvesting Safety Association (Greenslade is a paid employee and Decker chairs the Association’s Board). David Decker was an employee of the Fish Food and Allied Workers’ Union in 2020. These organizations collaborated with but did not fund or direct the research presented in this paper. At the start of the pandemic, the lead author, Barbara Neis, was an unpaid volunteer on the advisory committee for the NL Fish Harvesting Safety Association. The authors declare no personal relationships that could have appeared to influence the work reported in this paper.

Author statement

All authors contributed to the conceptualization of the manuscript, design of the online survey, review of draft and final manuscripts. Neis carried out the key informant interviews, transcribed the recordings and led manuscript development, literature review and synthesis (with support from Knott), and provided input into analysis of the online survey results. Lopez-Gomez and Reid-Musson led development of the online survey and Lopez-Gomez led analysis and reporting of the online survey results. Finnis contributed to survey design and interpretation of results. Greenslade, Decker and Knott reviewed draft manuscripts and provided editorial and other input in addition to the work outlined above.

Acknowledgements

Research funding and funding for open access publication was provided by the Ocean Frontier Institute’s Module I through an award from the Canada First Research Excellence Fund. The On the Move Partnership, supported by funding from the Social Sciences and Humanities Research Council of Canada, Grant No. 895-2011-1019, as well as, InnovateNL, Government of Newfoundland and Labrador, and the Canada Foundation for Innovation, provided in kind support. The funders were not involved in the conduct of the research or preparation of the article.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2022.105281.

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