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Fishing in turbulent waters: resilience, risk, and trust in British Columbia’s declining commercial salmon fishery

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Abstract

The impacts fishing communities face as a result of declining fisheries productivity and access may largely hinge on measurable attributes of their social resilience. Wild-origin Pacific salmon populations have been in a marked decline since the 1960s, resulting in progressively declining access for many commercial fisheries. More recent acute stressors have caused appreciable tribulation to commercial fishers in British Columbia, raising concern over their capacity to remain viable in the industry, and underscoring the need to examine the fishery under a social resilience framework. Here, we coupled an online survey instrument with in-depth interviews to assess commercial salmon fishers’ social resilience, socioeconomic characteristics, risk perceptions, trust in fishery management, and the relationships between these variables. Our results show that social resilience is low overall, with older, more experienced, and less diversified fishers being particularly vulnerable to declining salmon access. While 73% of fishers reported having plans to adapt to future declines in salmon access, 92% reported feeling that there are barriers impeding their adaptation, and 75% reported having no trust in fisheries management helping them adapt. Fishers’ social resilience was positively correlated with their trust in, and perceived trust from fisheries management.

Key words: socio-ecological systems, vulnerability, adaptive capacity, fishery declines, fisheries management, Pacific salmon

Introduction

Decades of anthropogenic stressors on aquatic ecosystems have caused a global fisheries crisis that is expected to worsen with the progression of climate change (Pauly 1995, 2008; Jackson et al. 2001; Nursey-Bray et al. 2012; Plagányi 2019; Silas et al. 2020). The implications of this crisis are multi-faceted for fisheries-dependent communities, which have been challenged with adapting to reduced catch per unit effort, local ecological changes, and increasingly restrictive management that is attempting to address these issues. Declining fisheries are associated with a suite of well-documented negative social impacts (Holling and Meffe 1996; Wingard 2000; Marshall and Marshall 2007), including increased rates of drug and alcohol use, psychological distress, and even mortality (Martin 2008; Scyphers et al. 2019).

Resilience theory is useful for understanding how environmental and policy change will impact resource users. The concept of resilience is rooted in ecological literature, where it describes the capacity of an ecosystem to persist in a stable state despite being subject to disturbance (Holling 1973; Holling et al. 1995). More recently, resilience theory has been adopted in the study of coupled human and natural systems, referred to as social-

ecological systems (SESS; Folke 2006; Gallopín 2006; Walker et al. 2006; Engle 2011). Resilient SESSs are often characterised by diversity in terms of species, human opportunities, and economic possibilities (Folke et al. 2002; Henry and Johnson 2015). SESSs with higher resilience can tolerate larger disturbances—political or environmental—without fundamentally changing and are flexible, adaptable, and prepared for the possibility of transformation (Gunderson 1999; Folke et al. 2002). In contrast, non-resilient SESSs are susceptible to irreversible and catastrophic change (Marshall and Marshall 2007). A core component of SESS resilience is social resilience (SR), which is the ability of groups or communities to cope with, or adapt to disturbances related to social, political, and environmental change (Adger 2000). SR is inherently connected to the concept of vulnerability, which is the state of susceptibility to harm imposed by environmental and social change (Adger 2006).

SR is widely recognised as a composition of several underlying attributes and processes that enable people and their respective SESSs to successfully cope with and adapt to change or crises (Maclean et al. 2014). Attributes of SR can be conceptualised and measured at both community

and individual scales. For instance, Maclean et al. (2014) describe community-scale SR as including: (1) knowledge, skills, and learning; (2) community networks; (3) people-place connections; (4) community infrastructure; (5) diverse and innovative economies; and (6) engaged governance. An important consideration is that community-scale analyses may risk concealing core resilience properties that predict how individuals within communities will respond to and be impacted by changes in access to natural resources. Therefore, understanding social resilience at the individual scale is crucial (Marshall and Marshall 2007; Sutton and Tobin 2012). Marshall and Marshall (2007) conceptualise individual-scale SR as including: (1) perception of risk associated with change; (2) perception of the ability to plan, learn, and reorganise; (3) perception of the ability to cope; and (4) level of interest in change. The same authors developed a 12-item survey tool for measuring individual-scale social resilience in natural resource management settings.

There is a growing recognition of the role that socio-cognitive attributes play in contributing to the SR of resource-dependent individuals. This includes risk perceptions—the subjective judgments individuals make about the likelihood of negative environmental or policy changes and the severity of harm they may cause (Darker 2013; McClenachan et al. 2020). Cognitive biases formed through previous experience of environmental or policy change have been shown to influence risk perceptions to either help build or erode levels of preparedness for future change (Cinner and Barnes 2019). Optimism biases may lead individuals to underestimate personal risk of change and take inadequate adaptive measures (Mortreux and Barnett 2017). Additionally, trust in resource governance institutions can be important for adaptation, with both high and low trust leading to poor adaptation outcomes (Stern and Coleman 2015). For instance, high levels of trust in institutions have been associated with complacency in the face of environmental change, whereas low trust can lead to non-compliance with institutional advice (Mortreux and Barnett 2017).

SR is critically important for fishing communities, which are considered highly vulnerable due to their reliance on fishery resources, and their exposure to coastal hazards (Adger et al. 2005; Marshall et al. 2007). Flexibility often plays a key role in enabling fishers' adaptation to change. For instance, fishers may exhibit flexibility by establishing alternative economic ventures outside of fishing, or by diversifying the fisheries they partake in (Finkbeiner 2015; Henry and Johnson 2015; Belhabib et al. 2016; Mohamed Shafri et al. 2019). Adaptation can also be linked to the degree of engagement in management and decision-making processes, with those least engaged being most vulnerable to change (Cinner et al. 2015). However, fishers' resilience may ultimately be constrained by structural factors: obstinate societal features, such as policies, procedures, and infrastructure (Stoll et al. 2021; Maltby et al. 2023). For example, engagement with decision-making processes may be limited by centralised management structures (Armitage et al. 2009), and flexibility may be hampered

by high costs of access to alternative fisheries (Carothers 2015).

Research aims

In Canadian fisheries, prior research has underscored the need for a better incorporation of human dimensions data—including fishers' socioeconomic concerns—in fisheries decision-making (Stephenson et al. 2019; Foley et al. 2020; Harper et al. 2023). At the same time, the concept of SR has shown promise as an analytical framework, providing an opportunity to help identify and mitigate potentially detrimental effects of change on vulnerable individuals and communities (Sutton and Tobin 2012). Here, using British Columbia's (BC's) commercial salmon fishery as a case study, we integrated Marshall and Marshall's (2007) 12-item tool with a survey instrument to measure fishers' individual-scale SR and explore their concerns for the industry's future. Additionally, in-depth interviews were used to contextualise select aspects of our survey results. We aim to advance community objectives of identifying socioeconomic dimensions of vulnerability in BC commercial salmon fisheries whilst contributing to the greater body of resilience knowledge. Our research builds on prior analyses that have examined the relationships between commercial fishers' social resilience and policy perceptions (e.g., Marshall 2007; Sutton and Tobin 2012), advancing the field by exploring how SR relates to socioeconomic characteristics, trust in management, and perceptions of risk.

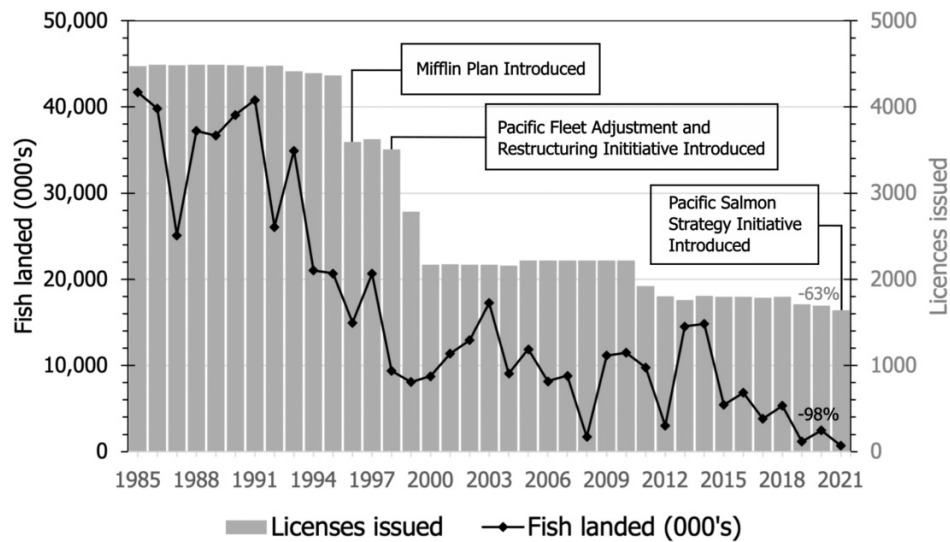
BC's salmon fishing landscape

In BC, Canada, the commercial Pacific salmon (*Oncorhynchus* spp.; hereafter salmon) fishery includes small boat (gillnet, troll) and large boat (seine) fisheries. The commercial fishery is one of three sectors vying for access to salmon, which also include the recreational fishery—the largest sector by number of participants—and the Indigenous food, social, ceremony (FSC) fishery. The FSC fishery is intended to ensure Indigenous communities can meet food security and cultural needs and is therefore given first priority in accessing salmon after conservation needs have been met. FSC licences are communal and prohibit the sale of catch. While the FSC fishery is not the subject of this paper, it is important to note that for many Indigenous fishers, participation in the FSC fishery is contingent upon earning enough take-home profit from the commercial fishery to maintain their vessels and equipment (Burke 2010). Due to the transboundary nature of salmon migration, and requirements set by the Pacific Salmon Treaty, US fishers also access Canadian-bound salmon, which are now considered to be “over-subscribed” (Nelson and Turris 2004).

The decline of salmon and the commercial salmon fishery

The abundance of wild-origin salmon across the Pacific Northwest has been in a marked decline since the 1960s despite efforts by both US and Canadian governments to conserve salmon and enhance stocks through the release of mil-

Fig. 1. Annual changes in the number of British Columbia commercial salmon fishing licences issued for all gear types (bars, right axis) and annual changes in the quantity of salmon landed (line, left axis). Series begins in 1985, the year of the industry's record landings. Major licence buy-back initiatives are overlaid. These data show a 63% decline in licences since 1985 and a 98% decline in fish landed. Data from sources: [North Pacific Anadromous Fish Commission 2023](#); [DFO 2023a](#).



lions of hatchery-raised fish (Nelson and Turris 2004). Declines have been driven by the cumulative effects of overfishing, forestry, damming, irrigation, pollution, gene dilution, and climate change (Nehlsen et al. 1991; Bradford and Irvine 2000; Mann and Plummer 2000; Lichatowich 2001; Quinn 2018; Crozier et al. 2021). By the early 1990s, worsening declines—particularly for several BC, Washington, Oregon, and California Chinook (*Oncorhynchus tshawytscha*) and Coho (*O. kisutch*) stocks—signalled a major crisis, sometimes called “the Pacific salmon crisis” (Noakes et al. 2000; Lichatowich 2001; Nelson and Turris 2004; Walters et al. 2019).

The decline of salmon has had profound implications for the flexibility and economic viability of commercial salmon fishers in BC. In response to salmon population declines, Fisheries, and Oceans Canada (DFO, the primary Canadian fisheries management agency) shifted to a precautionary management approach in the mid-1990s with the goal of reducing commercial fishing pressure (Nelson and Turris 2004). DFO instated the Mifflin Plan and the Pacific Fleet Adjustment and Restructuring Initiative (PFAR) in 1996 and 1998 respectively, which collectively reduced the commercial fleet to half its size by 2001 through licence buy-backs (Butler 2008). The Mifflin Plan also introduced the area/gear-based licensing model used today that requires fishers to purchase different licences for each gear type (gillnet, troll, or seine) and area that they intend to fish. Over the last three decades, continual reductions in exploitation rate have been achieved through shorter and fewer fishery openings (sometimes as short as 6 h), and gear-based limitations on retention of vulnerable species (Walters et al. 2019). Importantly, while the fleet size has diminished, total allowable catch (TAC) declined disproportionately over the last decade. Total commercial salmon landings in the 5-year period between 2018 and 2022 were 74% lower than in the preceding 5 years. In 2021, only 691 850 fish were landed, marking a record low and a >98% reduc-

tion from the industry's historical high in 1985 (North Pacific Anadromous Fish Commission 2023). Over this same period, the number of commercial salmon licences issued dropped by 63% (DFO 2023a), demonstrating that the small number of remaining salmon fishers are competing for an even smaller number of fish (Fig. 1).

For an already stressed industry, recent changes may pose further challenges, making this a key opportunity to examine SR. The 2021 Pacific Salmon Strategy Initiative (PSSI) aims to curb salmon declines with a more precautionary management approach that includes further fisheries closures and another licence buy-back initiative. Moreover, the 2021 United Nations Declaration on the Rights of Indigenous Peoples Act (UNDRIP Act), along with DFO's updated 2019 Fisheries Act, and 2019 Reconciliation Strategy, collectively commit Canada to facilitating better Indigenous commercial fishery access. This may have continuing implications for the allocation of salmon between and within various sectors, including the commercial fishery. Lastly, with climate change becoming a significant stressor on salmonid survival both in stream and at sea (Mantua et al. 2010; Abdul-Aziz et al. 2011; Crozier et al. 2021), the future of salmon and the commercial fishery is arguably more uncertain than ever.

Methods

Overview

We used BC's commercial salmon fishery (hereafter synonymous with salmon fishery) as a case study to examine core aspects of SR in commercial fisheries vulnerable to policy and environmental change. Our approach employed a broadly distributed online survey to measure individual-scale SR and investigate its relationships with socioeconomic characteristics, risk perceptions, and trust in fishery management. We

coupled our survey instrument with in-depth interviews to supplement our survey findings. Our research methods were reviewed and approved in April 2023 by the University of Victoria's Ethics Office (RAIS: Application 23-0105). In accordance with the process of informed consent, the purpose, objectives, and possible risks of the study were clearly outlined to participants prior to the collection of both survey and interview data. Acknowledging Indigenous data sovereignty and ethical research protocols more broadly, interview transcripts were made available to their respective participants. To ensure our writing accurately captured fishers' concerns, our manuscript was reviewed by one Indigenous and one non-Indigenous study participant whose responses we drew upon prior to submission.

Survey instrument

We developed our survey instrument with the intent to meet both community and academic research objectives. We designed our survey in close consultation with the United Fishermen and Allied Workers Union (UFAWU-Unifor), a union representing workers in various commercial fisheries across the province of BC. Our sampling frame included active commercial salmon fishers (hereafter synonymous with salmon fishers) across the province of BC. We targeted all salmon fishing gear types (gillnet, troll, and seine), Indigenous and non-Indigenous fishers, and owner-operators and vessel crew members. The survey was shared directly with 250 known salmon fishers via email and/or phone. Further sharing was done through social media (e.g., commercial fishing Facebook groups), newsletters, and contacting core industry representatives, such as the Commercial Salmon Advisory Boards, requesting the widespread sharing of the survey with any relevant contacts. UFAWU-Unifor played a key role in distribution by sharing the survey with their members. We used chain-referral sampling by asking survey participants to share the survey with other fishers (Biernacki and Waldorf 1981). When we found certain groups to be underrepresented (e.g., certain licence areas), we located industry contacts (e.g., area advisory board members) to help disseminate the survey link to these groups. The online survey was open from April to August 2023. While an overall response rate was difficult to estimate, 60 of the 250 contacts the survey was shared directly with responded, suggesting a response rate of 24%. However, given the survey was shared widely on social media and through snowball sampling, it is not possible to estimate a response rate for the remaining set of 42 responses.

Our survey instrument was used to collect data on demographics, risk perceptions, trust relationships with management, and SR (Supplementary material). We asked respondents to provide information including gear types, licence areas, towns of residence, gender, and age category. We assessed fishers' industry risk perceptions—which we define as fishers' perceptions of the likelihood of negative environmental or policy change impacting the industry—by asking questions regarding their concern for salmon, and the salmon fishing industry's future. Respondents were also asked to describe how they thought the fishery would look in 20 years, and to identify whether, how, and when they thought cli-

mate change will impact/is impacting the fishery. Personal risk perceptions—which we define as fishers' perceptions of the potential personal costs of change and the need to prepare to adapt—were assessed by asking fishers if they foresaw any change in the contribution of salmon to their future personal income, if they had plans to adapt to hypothetical declines in salmon access, and if so, what their adaptation plans were. We also asked fishers to identify any perceived barriers to their successful adaptation. Trust in management was evaluated by asking respondents to quantify their trust in DFO to conserve and recover salmon successfully, and aid fishers in adapting to policy change. We additionally asked respondents to quantify how much they felt DFO trusted them. Lastly, we adopted Marshall and Marshall's (2007) 12-item SR survey tool, modified for BC's commercial salmon fishing context.

We used a mix of open-ended and five-point/three-point Likert scale (e.g., “agree”, “neutral/uncertain”, “disagree”; see Supplementary material for all Likert scales used) questions in our measurement of risk perceptions. For measuring trust, participants were asked to rank their trust on a scale of “0” (no trust) to “10” (complete trust). Trust ranks were subsequently converted to percentages (0%–100%). Open comment boxes were also utilised in asking fishers to share their thoughts on the “Pacific salmon crisis”, and any comments or questions related to the survey. Our assessment of individuals' SR asked respondents to answer the 12 statements with their level of agreement on a five-point Likert scale (1 = “strongly disagree”; 2 = “disagree”; 3 = “neutral”; 4 = “agree”; and 5 = “strongly agree”; Likert 1932). Negatively worded statements were reverse coded to ensure that higher numerical values always indicated higher SR. We adopted methods in line with Sutton and Tobin (2012), whereby we used mean response scores across the 12 statements to generate a SR score for each respondent, operating on the assumption that our Likert scale was interval.

Surveys completed by non-active salmon fishers were removed from our analysis. However, given the depth of industry knowledge and adaptation insights many non-active fishers held, they were retained in the pool from which we later drew interviewees. We (1) measured the relationships between SR scores and nine socioeconomic variables (age, gender, years of fishing experience, multi-generationality, percentage of income earned from salmon fishing, gear type, number of gear types, number of licences, and role in the industry); (2) measured how SR scores relate to perceptions of risk; and (3) measured the relationship between SR scores and trust. Independent two-sample t-tests or Analysis of variance with Tukey's post hoc tests were used for analysing categorical variables, and Pearson correlation or Spearman's rank correlation were used for continuous variables. All statistical analyses were performed in IBM SPSS version 29.0. Qualitative survey data were analysed using inductive thematic coding.

In-depth interviews

Semi-structured interviews were used to supplement select aspects of our survey results, in particular to add depth to

core survey themes, and to investigate issues of trust more deeply. We aimed to interview a diversity of demographics. To identify interviewees, survey respondents were asked whether they had an interest in participating in follow-up interviews. Out of those who expressed interest, we used stratified purposeful sampling (Palinkas et al. 2015) to ensure the inclusion of individuals that: (1) shared thoughtful and informative dialogue in our survey's open-ended questions; (2) voluntarily identified as Indigenous; (3) had >50% of their income earned from salmon; (4) were owner-operators; (5) were multi-generational fishers; and (6) were women. We additionally aimed to have a balanced representation of gear types, licence types, and rural/urban areas. Our interviews were incentivised by \$50 CAD. Interviews were guided by core open-ended questions related to perceptions of trust, equity, sustainability, and adaptation in current and future salmon fisheries (Supplementary material).

Results

Sample characteristics

Our survey was completed by 102 active salmon fishers. These respondents ranged across all seven of our age categories—from 15–24, to 75 or greater—with most (28.7%) falling into the 55–64 age category. Due to a small sample size of younger fishers, we combined our two youngest age categories (15–24 and 25–34) for analysis. The age distribution of our respondents is comparable with other recent survey-based studies of North American fisheries (e.g., Smith et al. 2020; Harper et al. 2023), reflecting the typical “graying of the fleet” that is seen in many commercial fisheries (Cramer et al. 2018; Johnson and Mazur 2018). Our survey captured both male ($n = 95$) and female ($n = 7$) responses representing 44 locations across BC (Fig. 2). Respondents received a mean of 60.7% of their personal income from salmon fishing. One-third ($n = 30$) of respondents reported 100% income from salmon, and two reported 0% due to a recent lack of fishery openings in certain licence areas.

The majority of respondents were owner-operators (75%), with the remaining fishers identifying as vessel crew members (deckhands or skippers, 18% and 4%, respectively), and both owner-operators and crew (3%). Fishing experience ranged from 3 to 66 years, with a mean of 40 years of experience. All three salmon fishing gear types were represented in the sample, including gillnet ($n = 57$), troll ($n = 35$), and seine ($n = 28$). Most respondents were single gear-type users, while 10 reported dual gear use, and four reported triple. The majority of fishers (70%) held/had access to two or more commercial salmon area licences each. Most respondents reported being multi-generational salmon fishers ($n = 81$), with a mean number of generations of 2.9 (Table 1).

The majority of those surveyed ($n = 72$) agreed to participate in follow-up interviews. We conducted audio-recorded interviews with 23 of these fishers. Interviewees represented 15 locations across BC, and included 10 trollers, nine gillnetters, two seiners, and two multi-gear-type fishers (seine/gillnet, gillnet/troll). We did not ask our study participants whether they identified as Indigenous, though

four of the 23 fishers we spoke with had volunteered their Indigeneity in the survey. In total, 20 interviewees were owner-operators, 18 were multi-generational, and two were female. Similar to results from our survey, interviewees had a mean of 43 years of fishing experience, and made an average of 57% of their personal income from salmon fishing. Three recently retired fishers were included in this sample.

Dimensions of social resilience in the BC commercial salmon fishery

Our sample of 102 active fishers had a mean SR score of 2.86 (SD = 0.75; min = 1.0; max = 4.67) out of a range of possible scores from 1 through 5. This score is lower than neutral (neutral = 3), indicating low SR. Responses to particular questions reveal more about the nature of this result (Fig. 3). Most fishers (64%) were in agreement that they could cope with small changes in the industry (mean response score = 3.55); however, nearly all (79%) were in agreement that any further reductions in fishing opportunity would compromise their viability in the industry (mean response score = 1.94). The majority of fishers (55%) agreed that they felt too young to retire from salmon fishing, but too old to find other work (mean response score = 2.57). Moreover, most fishers (55%) agreed that they faced limited employment prospects outside of salmon fishing (mean response score = 2.57).

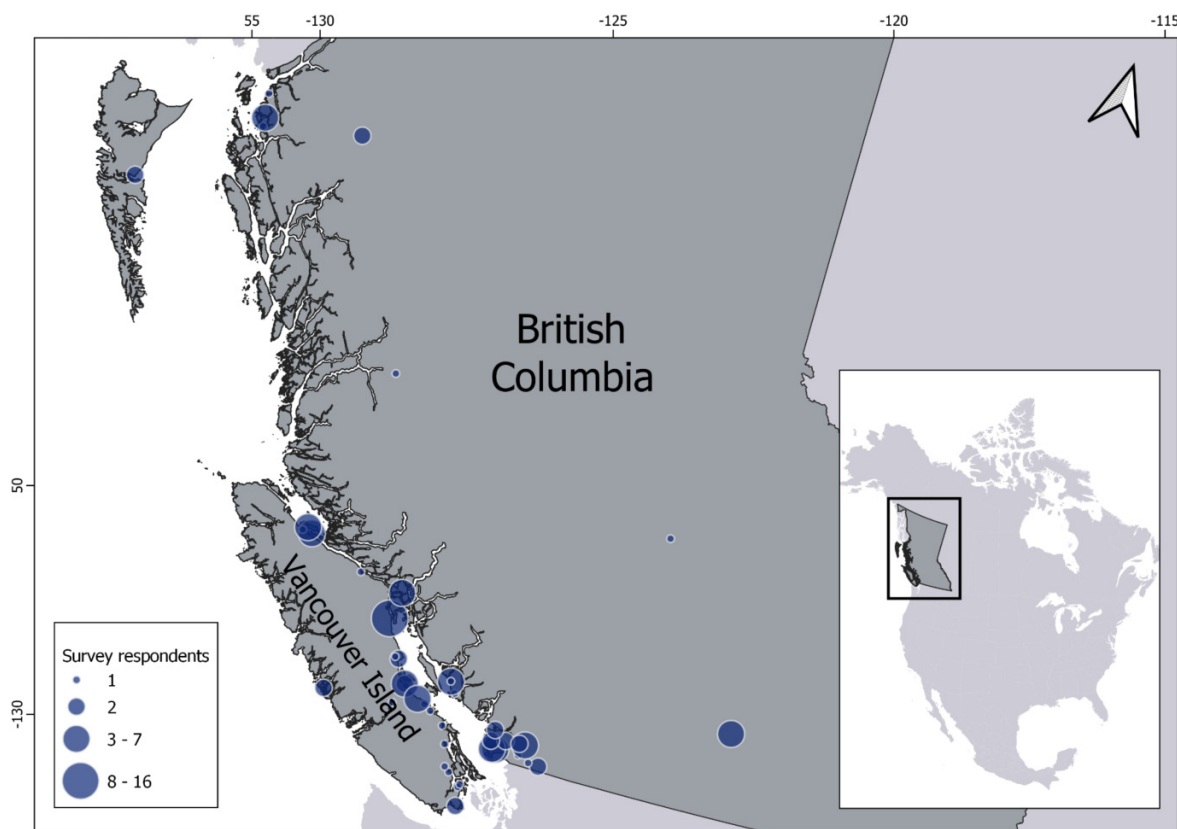
We independently tested the relationship between socioeconomic variables and SR scores, revealing three statistically significant relationships. SR scores differed significantly among three age categories, indicating a negative relationship between age and SR ($F(5, 95) = 4.156, p = 0.002$; Fig. 4a). Specifically, differences in SR were found between categories 15–34 and 65–74 ($p = 0.010$, 95% confidence interval, C.I. = (0.17, 1.91)), 15–34 and 75+ ($p = 0.032$, 95% C.I. = (0.06, 2.14)), and 35–44 and 65–74 ($p = 0.021$, 95% C.I. = (0.08, 1.50)). We additionally found significant negative relationships between SR and years of fishing experience ($r(98) = -0.46, p < 0.001$; Fig. 4b), and percentage of income earned from salmon fishing ($r(100) = -0.51, p < 0.001$; Fig. 4c). There was no relationship between gender and SR score, albeit the gender imbalance in our sample did not provide sufficient statistical power to reliably test this relationship. We found no significant difference in SR scores between owner-operators and all other roles (which were collapsed into one group due to the small sub-sample sizes), single-gear-type and multi-gear-type fishers, fishers with access to 1, 2, and 3+ area licences, and status as multi-generational versus non multi-generational fishers. The troll gear type had the lowest mean SR score of 2.69, while gillnet scored 2.89, and seine was 2.94; however, these differences were not statistically significant (see Supplementary material for all statistical results).

Perceptions of risk

Industry risk

Our results suggest that the majority of salmon fishers are expecting the future of the fishery to be characterised by extensive ecological, social, and political changes. All but

Fig. 2. The distribution of survey respondents' reported towns of residence across our study area, British Columbia, Canada. Figures were produced using QGIS® software, in Lambert azimuthal equal area projection, with basemap data from the Commission for Environmental Cooperation (cec.org).



one fisher (>99%) reported feeling concerned for the future of the industry (91% strongly concerned; 8% concerned; Fig. 5a). Similarly, 90% reported feeling concerned for the future of Pacific salmon (70% strongly concerned, 20% concerned). Several fishers demonstrated that their lack of concern for salmon was linked to the belief that declines in salmon populations are spatially isolated and/or temporally cyclical. For instance, one survey respondent wrote, "I've been doing this for a long time and you have your ups and downs for runs..." Another survey respondent described, "it has always been cyclical. My people have a phrase, "why-yum-gya-leese", which speaks to the many times in history when there were no salmon. They came back". When asked how the salmon fishery might look in 20 years, only 3% of survey respondents described optimistic visions, which were also linked to the belief that low salmon abundance was a temporary phenomenon. Most fishers held pessimistic views, with many expressing the belief that the salmon fishery would continue to decline over the coming two decades, and several expecting the industry's complete demise. These perceptions were related to anticipated declines in access, in particular for small boat (gillnet and troll) operators. As one survey respondent offered, "the changes they have made in allocation and time allowed to fish are nails in the commercial fleets' coffin".

Indigenous or corporate control of future commercial salmon fishing?

Many fishers' pessimistic perceptions of the future underscored tensions related to the allocation of salmon across Indigenous, non-Indigenous, and corporate user groups. Much concern was related to the impact of Canada's reconciliation with Indigenous peoples on the industry. In their visions of how the industry may look in 20 years, one-third (36%) of survey respondents (including both Indigenous and non-Indigenous) independently volunteered feeling that significant portions of future commercial TAC would be reallocated to Indigenous commercial or FSC interests. As one survey respondent described, non-Indigenous fishers are being "increasingly marginalised". Another respondent reported feeling that the industry has become "a political pawn for reconciliation purposes," and that "the future for the [non-Indigenous] commercial side of the industry is zero". Themes that arose from our qualitative survey data were also noted in our in-depth interviews; illustrative quotes of these themes from the latter can be found in Table 2 (see Table 2, quote 1). Yet while many non-Indigenous respondents perceived Indigenous fishers as having an advantage in fishery access, several Indigenous respondents did not agree. These respondents described the difficulties of having to recover from a

Table 1. Demographic characteristics of survey and interview respondents.

| Socioeconomic variables | Survey respondents | | | | Interviewees | | | |
|-------------------------------------|--------------------|--------|--------|--------|--------------|--------|--------|--------|
| | n = 102 | | n = 23 | | n = 23 | | n = 23 | |
| | N | % | Mean | SD | N | % | Mean | SD |
| Personal income from salmon fishing | | | 60.70% | 33.74% | | | 56.50% | 33.07% |
| Years of fishing experience | | | 40.25 | 14.90 | | | 42.96 | 12.55 |
| Age | | | | | | | | |
| 15–24 | 1 | 0.99% | | | – | – | | |
| 25–34 | 6 | 5.94% | | | 1 | 4.35% | | |
| 35–44 | 12 | 11.88% | | | 4 | 17.39% | | |
| 45–54 | 16 | 15.84% | | | 1 | 4.35% | | |
| 55–64 | 29 | 28.71% | | | 7 | 30.43% | | |
| 65–74 | 28 | 27.72% | | | 8 | 34.78% | | |
| 75+ | 9 | 8.91% | | | 2 | 8.70% | | |
| Gender | | | | | | | | |
| Female | 7 | 6.90% | | | 2 | 8.70% | | |
| Male | 95 | 93.10% | | | 21 | 91.30% | | |
| Role | | | | | | | | |
| Owner-operator | 77 | 75.49% | | | 20 | 86.96% | | |
| Deckhand | 18 | 17.65% | | | – | – | | |
| Skipper | 4 | 3.92% | | | – | – | | |
| Owner-operator and crew | 3 | 2.94% | | | – | – | | |
| Retired | – | – | | | 3 | 13.04% | | |
| Gear type | | | | | | | | |
| Gillnet | 57 | 55.88% | | | 9 | 39.13% | | |
| Troll | 35 | 34.31% | | | 10 | 43.48% | | |
| Seine | 28 | 27.45% | | | 2 | 8.70% | | |
| Number of gear types used | | | | | | | | |
| Single | 88 | 86.27% | | | 21 | 91.30% | | |
| Dual | 10 | 9.80% | | | 2 | 8.70% | | |
| Triple | 4 | 3.92% | | | – | – | | |
| Number of licences owned/accessed | | | | | | | | |
| None | 1 | 0.99% | | | – | – | | |
| One | 29 | 28.71% | | | 9 | 39.13% | | |
| Two | 49 | 48.51% | | | 9 | 39.13% | | |
| Three or more | 22 | 21.78% | | | 5 | 21.74% | | |
| Multi-generational? | | | | | | | | |
| Yes | 81 | 80.20% | | | 18 | 78.26% | | |
| No | 20 | 19.80% | | | 5 | 21.74% | | |

historically disproportionate loss of fishery access and highlighted the persistent challenges Indigenous communities face in accessing the capital required to compete in what was perceived to be an increasingly centralised, privatised, and corporation-controlled salmon fishery by-design. As one Indigenous survey respondent wrote, “they designed the system to steal boats and licences from our people and make sure we could not gain any wealth”. Another Indigenous respondent said, “on a scale of 1–10, communities stand at a 3 in terms of access and food security. How does a fisher continue to survive if the cost to fish even in our own territories [is] too high?” (also see Table 2, quotes 2 and 3). Indigenous fishers’ concerns surrounding privatisation were also shared with most non-Indigenous small boat fishers, one of whom

described a future vision where “only corporations will survive”.

How will climate change impact commercial salmon fishing?

We asked fishers about their perceptions of climate change, the majority of whom reported climate change as a current and future driver of change to salmon fishing (Fig. 5b). We found that 82% of fishers were concerned about climate change (37% very concerned, 45% somewhat concerned), while the remaining 18% were unconcerned. Most (77%) felt climate change would negatively impact the salmon fishing industry, while 21% felt climate change would have

Fig. 3. Fishers' responses to statements from our 12-item social resilience survey tool adapted from Marshall and Marshall 2007. Mean response scores for each statement are to the left of the distributional bars. Statements are listed in ascending order from lowest to highest mean response scores. Values <3 indicate negative leaning resilience. Statements denoted by † are negatively worded and were reverse coded before calculating mean response and SR scores.

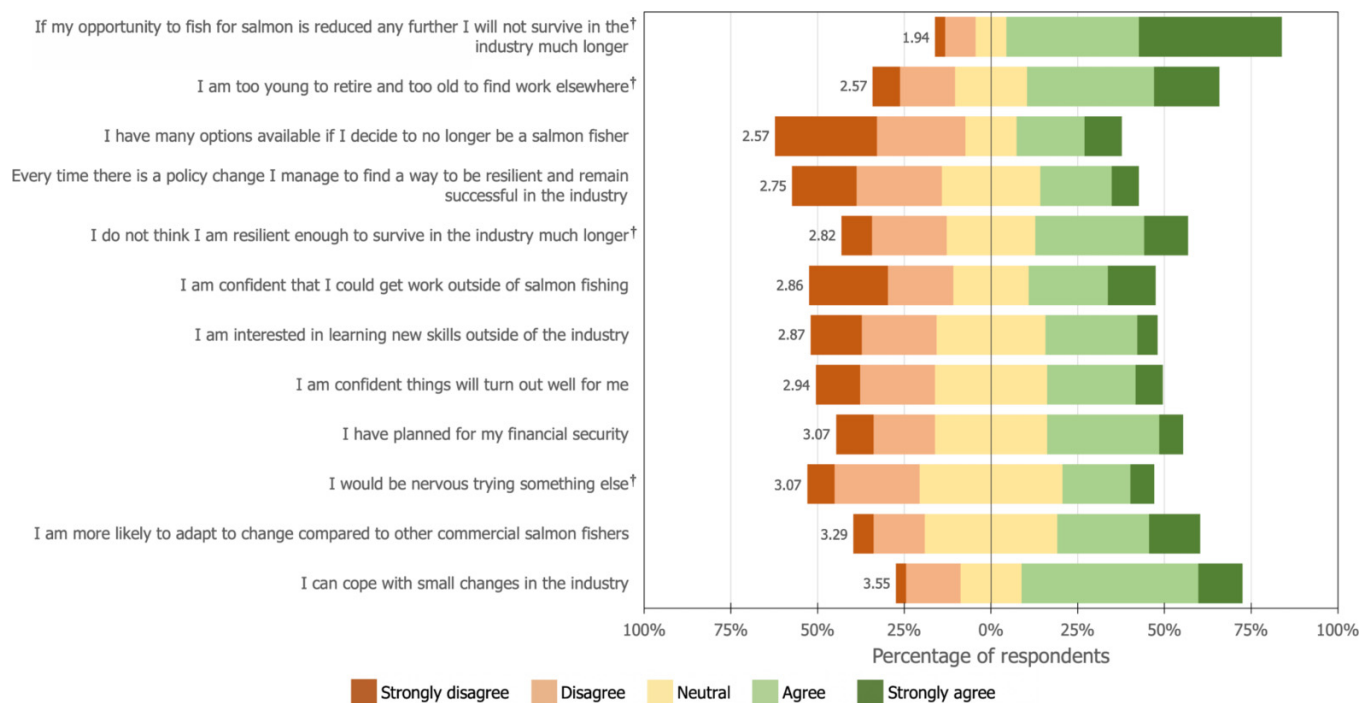
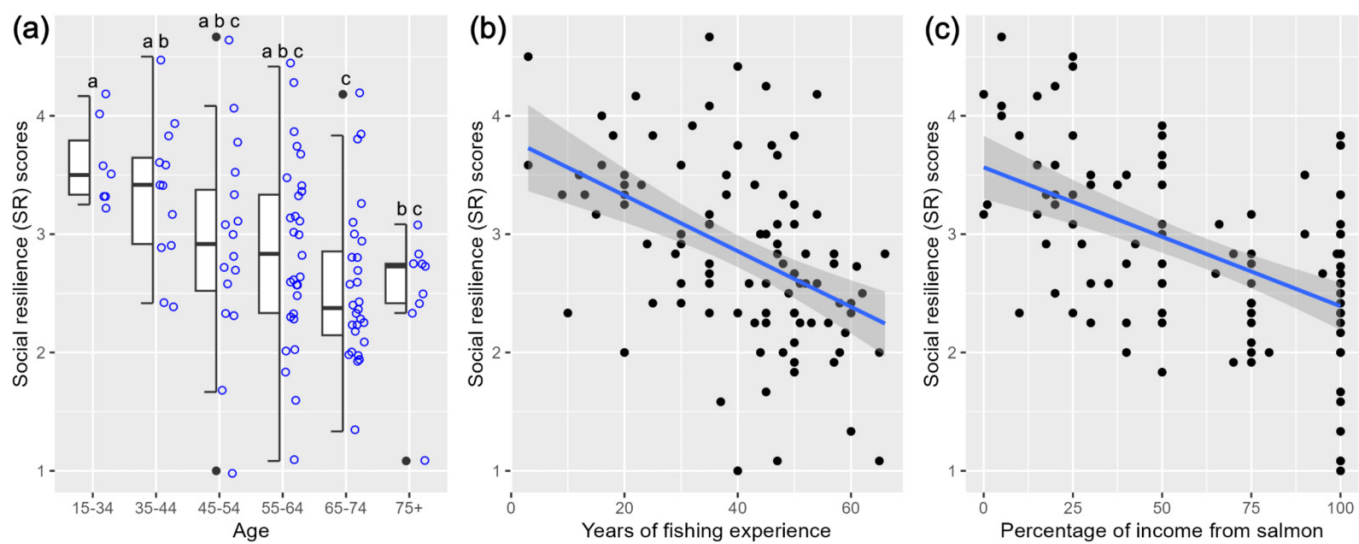


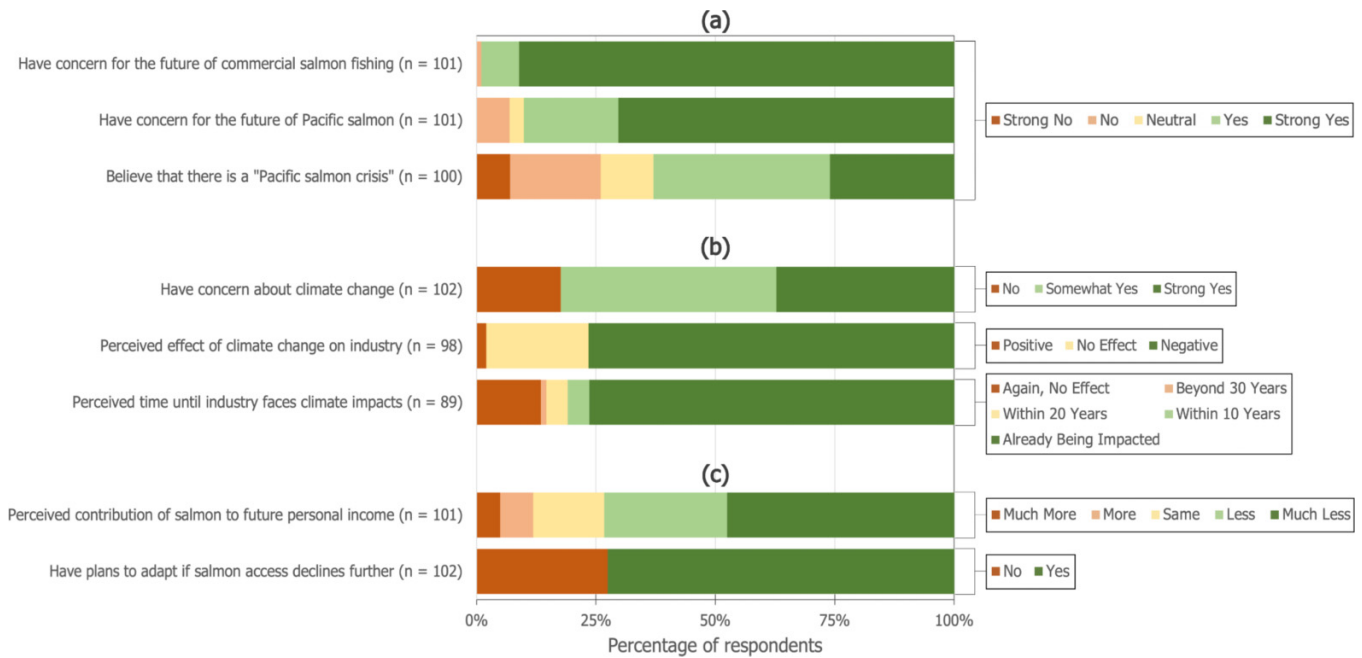
Fig. 4. Significant relationships between social resilience scores and (a) age, (b) years of fishing experience, and (c) percentage of income earned from salmon fishing. (a) Age category means denoted by the same letter are not significantly different.



no impact, and 2% felt the industry would benefit from climate change. When asked about the timeline of climate impacts (positive or negative) on the industry, the majority (76%) felt that the industry was already being impacted, while 10% felt it would be impacted within the next 20 years, 1% thought it would be impacted beyond 30 years from now, and 13% reaffirmed their belief that the industry would not be impacted.

Climate change was described as both a positive and negative driver of change to the Pacific region's commercial fisheries more broadly. While most survey respondents anticipated pernicious impacts on the salmon fishery, some identified positive change for other fisheries, including tuna, which one survey respondent described as seeing "more abundance due to warmer water shifts and feed migration north". Another survey respondent expressed concern that

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Fig. 5. (a) Fishers' perceptions of industry risk, (b) perceptions of climate change, and (c) perceptions of personal risk.

climate change would have even greater adverse impacts to other food production systems “which will increase pressure to restore and maintain the viability of wild capture fisheries, including salmon”.

Personal risk: adaptation plans and adaptation barriers

In addition to reporting concern for future changes to the industry, three-quarters (73%) of fishers who completed our survey reported that salmon fishing would contribute less to their future personal income than it does now (15% same as now; 12% more). Likewise, 73% reported having plans to adapt if access to salmon is further eroded (Fig. 5c). Those with adaptation plans had significantly higher SR scores than those without (mean = 3.06, SD = 0.71, vs. mean = 2.34, SD = 0.64; $t(100) = -4.69$, $p < 0.001$; Fig. 6a). Moreover, those with plans to adapt were less experienced on average (mean = 37.42, SD = 14.87, vs. mean = 47.54, SD = 12.50; $t(98) = 3.19$, $p = 0.002$; Fig. 6b), and obtained a significantly lower percentage of their personal incomes from salmon fishing (mean = 51.06, SD = 33.16) than those without plans (mean = 86.07, SD = 19.07; $t(83.64) = 6.64$, $p < 0.001$; Fig. 6c). Adaptation plans included diversification to other fisheries (53%), marine-related careers outside of fishing (18%), other unspecified work (16%), value-adding (4%), and fisheries management (3%). Several fishers (14%) described planning to adapt simply by selling out or retiring from the industry, though among many this was mutually expressed as feeling more akin to what one survey respondent described as “forced retirement”.

While most fishers had adaptation plans, 92% identified barriers to successful adaptation. Among these barriers, financial constraints were reported by many as a major obsta-

cle. In particular, fishers seeking to adapt by diversifying perceived high costs of licences and gear as a major challenge. As one survey respondent described, “I would like to continue fishing, but licences and boats are completely out of reach” (also see Table 2, quotes 4 and 5). Yet while fishers expressed concern for the rising costs of diversifying to other fisheries, several described commensurate concern with the contrasting loss in value that salmon licences and gear have incurred as a result of the fishery’s decline. Many fishers reported feeling trapped between having to stay in the industry and suffer from limited access to fishery openings, or retire and sell their licences for a fraction of their original value. One survey respondent wrote, “I spent my working life in the industry. What do I do with my boat and licence if I retire?... [they] will be worthless if there is no access to the resource. They are the equity of my small business operation”. Those fishers seeking to leave the industry are able to sell licences to other fishers, or back to DFO through the PSSi’s Pacific Salmon Commercial Licence Retirement Program (PSCLRP). Like prior licence buy-backs (such as the Mifflin Plan and PFAR), this program is based on a reverse-auction process whereby fishers willing to sell their licences for the lowest price are the ones bought out. While DFO does not disclose its typical offer valuations for buy-backs given it compromises the reverse auction process, respondents who mentioned the PSCLRP universally described valuations as unfair. As one survey respondent wrote, “they have done absolutely everything short of completely shutting down our fishery to try to railroad us to bankruptcy and have to accept peanuts for a license retirement” (also see Table 2, quote 6).

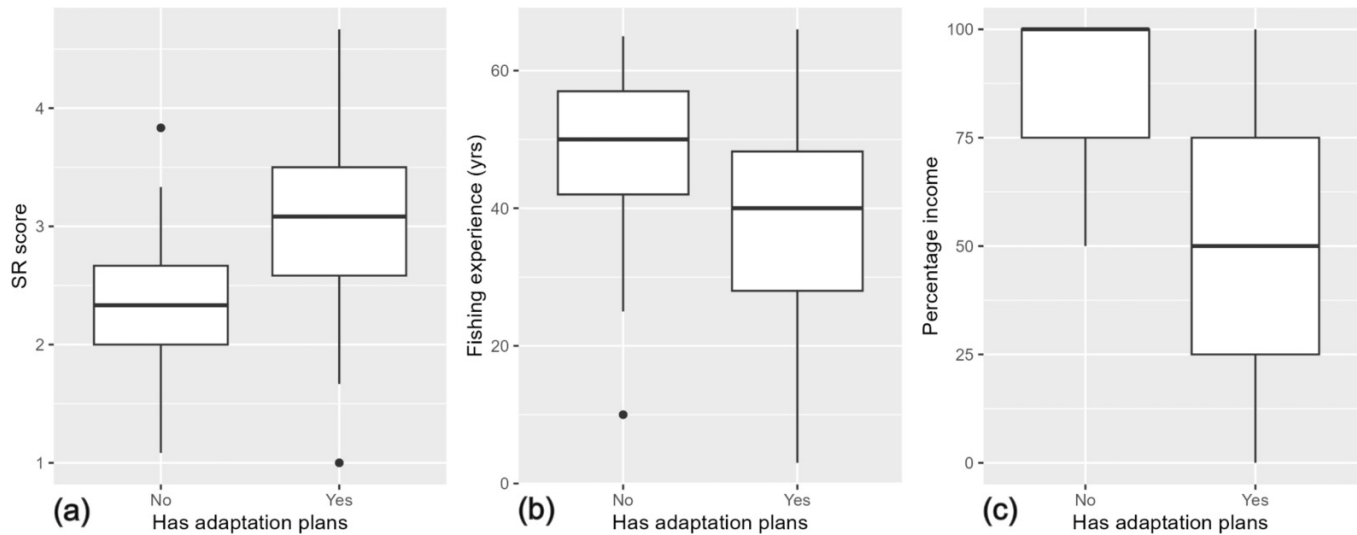
Adaptation barriers related to fisheries management and policy were also frequently described by respondents. One commonly raised concern was a lack of communication and transparency in decision-making by DFO. As one survey re-

Table 2. Quotes from our interviews that illustrate core survey themes.

| Corresponding section heading | Core survey themes | Illustrative quotes from interviews |
|--|--|--|
| Indigenous or corporate control of future commercial salmon fishing? | Non-Indigenous fishers are concerned about the impact that reconciliation will have on them in the future | 1. “We’ve hashed out allocation policies that have worked, and of course now we have the truth and reconciliation dynamic thrown in there, so they have to revamp the whole thing... That whole truth and reconciliation thing, I could accept that. You know, if that’s the way they want to do it. But, I can’t accept not being compensated... Our fishing fleet in Sointula is falling into ruin. There are five derelicts for every boat that will go fishing this year.” (non-Indigenous gillnetter) |
| | Indigenous fishers have suffered a historically disproportionate loss of fishery access with continuing implications | 2. “We’ve lost 20 years of [fishing] livelihood for our youth. Who took it away? Government of Canada... How do you tell the government of Canada, you killed us? I’ve told them in meetings in Ottawa, come and walk in my village. Come and walk in my village and see what you’ve done to my people.” (Indigenous seiner) 3. “When we talk about commercial fishing, the benefits that come from that is the food security needs for our community. I grew up that way, always providing not only for family but community. One of the things that’s so important and so scary is that we’ve lost so many boats through the years as these policy changes have come about... It’s been a real struggle for us just to keep our boats... we call it a graveyard now. You know the guys can’t afford to do their upkeep on the boat, so they just give up and take em’ to a beach and an excavator rips em’ apart.” (Indigenous gillnetter) |
| Personal risk: Adaptation plans and adaptation barriers | Fishers perceive structural factors as inhibiting diversification | 4. “To go fish something else costs hundreds of thousands if not millions in access... It’s just not that simple. There are people that decided a long time ago that they were going to be salmon fishermen, and you know they had ups and downs, but they made a living and life was good”. (non-Indigenous gillnetter) 5. “One of the biggest things that DFO needs to do right now is un-marry licences... Un-marry licences so that it’s more attainable for someone to diversify in small and reasonable amounts, as opposed to right now where you have to buy a package, because that’s the only way licences come, because their married. Or, you have to lease off of someone who owns them, because you can’t buy them, because they’re in a package. Or, you have to lease off of a fish buyer, because they’re the only ones who have the capital to buy a package”. (non-Indigenous troller) |
| | Fishers are reluctant to leave the industry due to a perceived loss of investment | 6. “They introduce a [licence] buyback... but first they destroy the open market for a salmon licence. So then that’s what they deem the value to be... They force us to bid against each other, and the lowest guy gets bought out. Do you see any fairness there? I personally have close to a quarter of a million invested in my licences. That’s what I’ve paid for them, and with 1986 and 1995 dollars. What’s that worth now?... For what their offering in a buyback program, like fifty thousand dollars, its an insult”. (non-Indigenous gillnetter) |
| | Fishers believe a lack of communication from DFO undermines their ability to plan and exercise resilience | 7. “There is absolutely no transparency with DFO. They don’t tell us anything. Everything is like a big secret. How hard would it be to say, “we are waiting for the escapement number to be this much [before opening a fishery]”. So fishermen at any given time could go look at the escapement number and go, “oh we’re nowhere near that, okay I can go do something else”... Or, “oh look we’re getting real close, I’m not going to switch over my gear because they might actually open it”. Simple things that would make it really easy for fishermen to at least plan. But they don’t tell us anything, it’s just either yes or no, go or no-go”. (non-Indigenous troller) |
| Trust | Fishers’ trust in DFO is very low | 8. “The bigger issue here is that DFO needs to earn our trust, because at this point in time DFO has broken that. We don’t trust DFO, and we’re gonna continue to scream and yell that DFO is failing us”. (non-Indigenous troller) |
| | Fishers are concerned that DFO is not addressing the perceived greater threats that salmon face | 9. “The first thing that DFO has done over the decades is say that we are overfishing commercially, so let’s get rid of the commercial fisher... You know what, you’re not getting any result from that. That has happened time after time after time... You know why the [fish] aren’t returning? Because every year they come back they are passing beside [open net-pen aquaculture]. We are killing them, and we are allowing it”. (Indigenous troller) |
| | Fishers have varying levels of trust in different scales of DFO management | 10. “Our local managers are fantastic. I feel like the trust gets lost [because] there’s a loss in translation from the person on the ground talking to the fishermen to the people who are making the decisions. And I honestly feel that the current governments’ people who are making decisions are so disconnected and do not actually have a good grasp on our industry, nor do they have a good grasp on what impacts their decisions have [on fishing communities]. I think [DFO’s decisions] are guided by public perception... and heavily influenced by lobbyists... I honestly feel that DFO has moved away from being a scientific body to a body that manages public perception and political aspirations”. (non-Indigenous troller) 11. “Do I have confidence in the local guys? Absolutely. Are they giving the messages? Absolutely. Is it being heard at national headquarters? Mmmm, it’s being heard. But is it being adhered to? They don’t care. They don’t care”. (Indigenous troller) |

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Fig. 6. Significant differences in (a) SR score, (b) years of fishing experience, and (c) percentage of income earned from salmon between fishers with and without stated adaptation plans.



spondent wrote, “DFO has left fishermen completely in the dark” (also see Table 2, quote 7). In particular, several fishers expressed frustration over unexpected and last-second decisions made to open or close fisheries, with one survey respondent describing the exertion of “having to prepare and invest for the season and possibly [being] told we can’t fish at the last moment”. Many survey respondents perceived DFO as currently being in a state that one respondent described as “organisational uncertainty”, lacking a clear direction, and causing fishers to feel “unable to plan for the future”. Fishers also identified particular DFO policies that they perceived to reduce flexibility and hinder adaptation. For example, DFO’s policy of marrying commercial fishing licences, which requires fishers in vessel-based licence fisheries (such as salmon) to unify all licences (salmon or otherwise) allocated to—or, “stacked” on—their vessel. Once married, licences become inseparable for sale or transfer, creating a barrier to diversification into and outside the salmon fishery. Similarly, married licences “take on” the length of the vessel they are assigned to, limiting the number of potential buyers (also see Table 2, quote 5).

Trust

Survey findings

Our survey found trust in DFO and perceived trust from DFO to be very low overall, but weakly positively correlated with SR scores. Fishers had a mean level of 6% trust in DFO helping them adapt to change, with 75% of respondents reporting that they had zero trust. This is reflected by fishers’ perceptions that management had imposed barriers to adaptation as described above (also see Table 2, quote 8). Fishers additionally had low trust in DFO’s capacity to successfully conserve, recover, or sustain salmon populations, with a mean trust level of 10%, and 66% reporting zero trust. When

it came to perceived trust from DFO, fishers had a mean trust level of 14%, with 60% reporting zero trust. While our results were skewed towards zero, we found higher SR scores among those who had greater trust in DFO helping them adapt to change (Spearman’s ρ : $r(100) = 0.30$, $p = 0.002$), and effectively conserving salmon (Spearman’s ρ : $r(100) = 0.33$, $p < 0.001$). Fishers who perceived greater trust from DFO also had higher SR scores (Spearman’s ρ : $r(99) = 0.28$, $p = 0.005$). We did not exclude zeros in testing for correlation.

Comments received across our survey’s open-ended questions suggest that low trust in DFO’s ability to conserve salmon is linked to the belief that DFO’s conservation approach is focused on addressing commercial fleet fishing pressure while avoiding larger problems such as riparian habitat degradation and Atlantic salmon aquaculture—which may require cooperation with the Provincial government and Indigenous Nations. As one survey respondent described, “environmental factors have had a significant and deleterious impact on the viability of [salmon]. The principal management response has been to reduce harvest, which has not restored the stocks but has had a profound negative impact on the socioeconomic viability of commercial [fishers]” (also see Table 2, quote 9). Fishers additionally described feeling that in comparison to other sectors such as recreational and FSC, the commercial fleet bears a disproportionate weight of conservation measures—such as monitoring, enforcement, and fishery closures. This also may have contributed to most fishers’ belief that DFO did not trust them.

Interview findings

Our in-depth interviews investigated the specifics of trust further. We found that fishers’ levels of trust in DFO varied depending on the organisational scale in discussion, particularly among local, Pacific regional, and national levels of management. While overall trust in DFO as a fisheries

management body was low, nearly all participants (96%) from our in-depth interviews expressed high trust in local managers, whose responsibilities are limited to designated watersheds. Local managers were seen as trustworthy and trusting of fishers due to their regular engagement with fishers, their local knowledge, and their willingness to appeal to fishers' concerns. However, local managers were also described by many as having their "hands tied" and not having authority to make any decisions. At the Pacific regional level, management was viewed as knowledgeable regarding local issues. However, their centralisation in Vancouver—away from most fishing communities—and their perceived alignment with priorities identified by DFO's national scale of management led fishers to feel conflicted over their trustworthiness. Trust was invariably recognized as non-existent for the national level of management, which some fishers simply referred to as "Ottawa" or "the decision makers". For most, distrust in this level of management stemmed from its ties to Canada's political system, whereby the Minister of Fisheries is an appointed politician, often with no background in fisheries and with sweeping discretionary powers. Management at the national level was perceived as disinterested in engaging with fishing communities, lacking local fishery knowledge, and making decisions that prioritised political interests over recommendations made by local managers (also see [Table 2](#), quotes 10 and 11).

Discussion

We found SR in BC's salmon fishery to be low. The average SR score of 2.86 corresponds to negative leaning SR (<3.00). This score was largely driven by many fishers expressing their concern for both their ability to remain viable if there are further reductions in access to salmon, and their ability to find work outside of the industry. As compared to other fisheries that have been assessed with the same tool, 2.86 is low. For example, [Sutton and Tobin \(2012\)](#) found a mean SR score among Australian commercial and charter fishers of 2.99. Other fisheries assessed with this tool have demonstrated positive leaning SR (e.g., average scores above neutral; [Marshall and Marshall 2007](#); [Marshall et al. 2009](#)). The low SR scores reported here are contextualised by the extensive nature of our respondents' perceived barriers to their adaptation.

We found that socioeconomic characteristics—specifically age, years of fishing experience, and percentage of income earned from salmon—were correlated with salmon fishers' levels of SR. Fishers who were younger, less experienced, and earning less income from salmon were generally more socially resilient. These same socioeconomic predictors of SR were also identified in Australian commercial fisheries ([Sutton and Tobin 2012](#)). Our finding that fishers with a lower reliance on salmon were more resilient is expected given that diversification can reduce economic risks associated with resource dependency ([Finkbeiner 2015](#); [Matsuzaki et al. 2019](#)) and enable greater flexibility ([Silva and Lopes 2015](#)). However, considering that our study did not find a relationship between fishers' SR scores and their number of licences or gear types used, our results suggest that diversification within the salmon fishery alone is not a desirable strategy to increase SR.

This is not surprising considering that salmon fishery openings across licence areas often coincide ([Butler 2008](#)). The lower SR of older and more experienced fishers may in part be explained by the tendency for this demographic to have more occupational attachment ([Marshall and Marshall 2007](#)), and greater resistance to learning new skills ([Silva et al. 2020](#)). However conversely, other research has shown that older and more experienced fishers can also be less socioeconomically vulnerable ([Villasante et al. 2022](#)), and more resilient due to greater accumulated knowledge ([Teh et al. 2012](#)).

Our results illustrate the role that structural factors related to licencing have in inhibiting individuals' SR in Canadian Pacific fisheries more broadly. Many fishers described their ability to diversify as constrained by policies that have driven increased costs for many Pacific commercial fishing licences and quota, and moved fisheries access and income out of local communities. Demand and speculation from investors have been enabled by the privatisation and rights transferability (e.g., transferable quotas) of Pacific fishery resources, and the lack of an owner-operator policy. As a result, licences have concentrated under corporate, foreign, and investor control, and the prospect of licence ownership has slipped out of the reach of many young fishers and those from rural and Indigenous communities ([Haas et al. 2016](#); [Silver and Stoll 2019](#); [Bennett et al. 2021](#); [Silver and Stoll 2022](#)). This problem is not unique to Canada (see [McClenachan and Neal 2023](#)) and results from global efforts to address the ecological devastation caused by overcapitalised and open access industrial fisheries ([Wingard 2000](#)). Without licence ownership, many fishers resort to signing quota lease agreements with licence owners such as fish processors, or so called "armchair fishermen", who lease their quota as passive income. Lease prices are often high to the point that lessee operators may struggle to cover basic operating costs, crew shares, and to reinvest in their vessels to improve safety and performance ([Edwards and Pinkerton 2020](#)). As highlighted by our respondents, DFO's policy to marry stacked vessel-based licences only further exacerbates licence affordability and de-localisation issues, as licence packages are often only affordable to corporate buyers. These challenges signal that bolstering SR will require a major policy overhaul. UFAWU-Unifor has been particularly vocal in this regard, advocating for the need to prevent investor and corporate ownership of licences through developing owner-operator policies, and incentivising new entrants with low interest loans ([UFAWU-Unifor 2021](#)). Other scholars have recommended considering claims of resource adjacency in allocating access rights ([Bennett et al. 2018](#)).

While our study indicates that salmon fishers exhibit low SR on average, a glimmer of optimism emerges as a substantial cohort of less experienced individuals within the industry demonstrates a proactive stance towards adaptation—despite their perceived adaptation barriers. We found that 73% of fishers reported having plans to adapt if there are further declines in access. On average, these individuals had significantly higher SR scores than those without adaptation plans, highlighting a strong linkage between perceptions of personal risk and SR. These individuals were realistic about the risks associated with the industry, many of whom reported having "already diversified", as corroborated by their smaller

average proportion of personal incomes earned from salmon. These fishers were united by the recognition that “the good old days just don’t exist anymore”, and that irrespective of distaste for current management, the only way to persist in the industry’s uncertain future is to be flexible and prepared for change.

We demonstrate that fishers’ trust in DFO is very low, and positively correlated with their SR. Distrust in management is a commonality in fisheries. For example, among Maine lobstermen, 62% reported not trusting managers (McClenachan et al. 2020), with decreasing trust in federal as compared to regional fisheries management institutions (McClenachan and Neal 2023). Likewise, 48%–62% of small-scale Brazilian fishers reported having no trust in various institutional actors involved in fisheries management (Silva et al. 2021). However, the trust in fisheries management reported here is low in comparison to these aforementioned studies, with 66% and 75% of salmon fishers reporting having no trust in DFO’s ability to conserve salmon and help fishers adapt, respectively. Trust is often regarded as important in driving SR (Stern and Coleman 2015; Mortreux and Barnett 2017), and prior research has demonstrated that fishers’ trust in management can be a predictor of both initial and persistent psychological trauma following fishery collapse (Scyphers et al. 2019). Trust and SR are particularly important in the context of Canada’s commitment to ecosystem-based fishery management (EBFM), which requires management institutions to effectively draw on diverse knowledge, abilities, and viewpoints to achieve sustainability targets (Glenn et al. 2012; Stephenson 2012; Stern and Baird 2015).

Taken together, our results suggest that fishers are experiencing a major loss of “systems-based trust”, that is, trust in the rules, procedures, and policies that define salmon management and Canadian fishery and resource management more broadly (Stern and Baird 2015). In particular, fishers demonstrated a diminished faith in the equity of management systems across two scales. First, within commercial fisheries, tensions between Indigenous and non-Indigenous fishers were small in comparison with the consensus that the concentration of licence ownership in the hands of corporations/processors is inequitable. This well-documented problem in Canadian Pacific fisheries (Haas et al. 2016; Silver and Stoll 2019; Bennett et al. 2021; Silver and Stoll 2022) may be driven by a lack of knowledge of, and agreement over social performance indicators in fisheries (Stephenson et al. 2019), or a conflation of social with economic performance indicators (Brooks et al. 2015). Second, we found that a key component of low trust is related to perceived inequities in the Federal government’s natural resource decision-making, which has reduced access to commercial salmon fisheries, yet has failed to work with the BC government to address the legacy of industrial logging in riparian salmon habitat, and continued to allow foreign-owned Atlantic salmon aquaculture in BC waters despite established negative effects on wild salmon (Bass et al. 2022; Bateman et al. 2022)—a decision heavily critiqued by the scientific community (Godwin et al. 2023). Fishers perceive that the narrow focus on reducing commercial exploitation rates—without simultaneously taking extensive measures to reduce the massive impacts from

destructive industries whose benefits are concentrated in corporate owners outside the province—is a failure to prioritise conservation, and instead yielding to powerful industry lobbyists.

Our results must be viewed within the context of Canada’s ongoing efforts to reconcile with Indigenous peoples after centuries of dispossession and marginalisation (Truth and Reconciliation Commission of Canada 2015). The imposition of colonial policies and fishing practices in Indigenous territories acted to—and continue to act to—erode northwest coast Indigenous peoples’ long-standing connection to their marine resources, including salmon (Atlas et al. 2021; Steel et al. 2021). Mounting local and international pressures (e.g., UNDRIP), and—most importantly—the assertion of aboriginal rights by Indigenous communities in court have resulted in a legal and policy landscape that is gradually shifting to better enable Indigenous fishers to access their territories’ marine resources (Bennett et al. 2018). Yet Indigenous ownership of commercial salmon licences has decreased disproportionately to other user groups over the last three decades (Butler 2008; DFO 2015). Many Indigenous fishers have now become reliant upon DFO’s Pacific Integrated Commercial Fisheries Initiative (PICFI program) to access commercial fisheries, including salmon. The PICFI program requires Indigenous communities seeking fishery access to create and manage “corporate style” Commercial Fishing Enterprises (CFEs) which are annually designated DFO-owned commercial fishing licences (accrued through the successive commercial sector licence buy-backs). Fishers can then sign lease agreements with CFE’s to obtain commercial fishing access in the form of temporary licences or quota. While PICFI aims to support Indigenous engagement in commercial fisheries, the PICFI CFE structure can lead to challenges for fishers. First, Indigenous fishers can face uncertain long-term access since licences are designated to CFE’s annually. Second, CFE’s are not united by a standard management structure or policy requirements for leasing, meaning that Indigenous fishers may not have guaranteed priority over other quota/licence applicants (non-Indigenous fishers or corporations) or access to affordable lease rates. Indigenous fishers rely on profitable engagement in commercial fisheries to maintain vessels required in the FSC fishery and support their communities’ food security (Burke 2010). Clearly, more work is needed to ensure that Indigenous fishers can participate and thrive in commercial salmon fisheries. Moving away from “corporate style” lease-based licence systems and towards the transfer of commercial quota/licence ownership and control to Indigenous fishers may be an important next step in seeing this happen, and in recognising aboriginal rights, title, and autonomy. This is particularly salient because the majority of territory in BC was never ceded to the Canadian state in the first place. Given that some of our Indigenous survey and interview respondents expressed concerns surrounding food security and FSC fishery access, future research with Indigenous communities in BC should explore the relationship between commercial fishery access and food security/food sovereignty. This is particularly important for those communities that are most isolated and have historically suffered disproportionate losses of commercial fishery access.

Finally, there are important methodological limitations that should be recognised when interpreting our results, particularly for the survey. First, our statistical power is limited due to a low response rate and small sample size, particularly when comparing SR scores between sub-samples. Second, our low SR scores and overall pessimistic results could be attributed to a survey bias, with those eager to express their concerns most likely to complete the survey (non-response bias; Fisher 1996). However, this dominant pessimistic narrative is supported by other research in Canadian Pacific fisheries (Bennett et al. 2021; Harper et al. 2023) and our optimistic respondents describing themselves as “few and far between”. We also aimed to reduce the likelihood of non-response bias by taking steps to increase response rate and sample size (Krenzke et al. 2006; Mason et al. 2020). This included providing (1) the opportunity to remain anonymous, (2) a short length (<15 min) that did not require the completion of written sections to be submitted, (3) a user-friendly online format, (4) regular reminders to complete the survey, and (5) an entry into a \$200 prize draw. Lastly, there are limitations with relying solely on individuals’ perceptions to measure their SR (Sutton and Tobin 2012). Perceptions are subjective beliefs rather than objective measures, and as such our measures of social resilience should only be considered as measures of perceived SR. Developing objective measures of SR should be a key consideration moving forward.

Conclusions

Following global fisheries declines, fisheries management practices trended towards centralised and precautionary approaches that prioritised the recovery of fish stocks through extensive exploitation reductions (Worm et al. 2009). While often successful at a biological level (Hilborn et al. 2020), this approach has come under heavy criticism for its impacts on small scale fishers and fisheries dependent communities (Stephenson et al. 2019). Recently, global discourse on fisheries has acknowledged the need for fisheries management to consider models such as “full spectrum sustainability”, which incorporate broader sets of social and cultural objectives in decision making (Ommer et al. 2012; Foley et al. 2020). Within this context, our study shows that both SR in BC’s commercial salmon fishery and trust in management are very low, and consequently, many salmon fishers may be vulnerable to any further erosion of access. Our results suggest that structural factors are reducing fishers’ flexibility, and disengaging them from management processes, which—given the known positive relationship between social resilience and both of these attributes (Cinner et al. 2015; Finkbeiner 2015)—is further eroding SR and restricting adaptation. In the face of unprecedented challenges, BC’s salmon fishery stands at a crossroads. By heeding the insights gleaned from this study and embracing a forward-thinking approach that centres on re-routing benefits away from corporate interests and towards small-scale fishers, it may be possible to bolster vibrant fishing communities across BC’s coast once again. Focusing on addressing these social challenges Canadian Pacific fisheries face will be a crucial pathway towards re-building the trust between fishers and DFO required to

meet the PSSI’s objective of “integration and collaboration” (DFO 2023b) and successfully conserve salmon under an EBFM framework.

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Data availability

Data from this study are not available due to data sovereignty and confidentiality agreements with research participants.

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Competing interests

The authors declare there are no competing interests.

Supplementary material

Supplementary data are available with the article at <https://doi.org/10.1139/facets-2023-0204>.

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