Fisheries rebuilding success indicators: 2023

Rebecca Schijns and Robert Rangeley
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Summary
Oceana Canada's seventh annual assessment of fisheries rebuilding indicators reveals that Canada's science and management of marine fish and invertebrate populations are not on track to meet national and departmental commitments. With the accumulation of threats like climate change, overfishing, and pollution, the urgency to rebuild abundant marine ecosystems is greater than ever. Overall, the state of Canada's marine fisheries can be summed up as:

- Unhealthy: A third of marine fish and invertebrate populations are either critically depleted or in the cautious zone, and less than one-third can be considered healthy;
- Without a status: Nearly forty per cent of all marine fish and invertebrate populations are classified as uncertain due to insufficient reference points and stock status information;
- Without a plan: Only six of 28 critically depleted stocks have a rebuilding plan, and none of those are high quality. These few plans fail to meet the criteria laid out in the *Fisheries Act* rebuilding regulations. There were no new rebuilding plans published this year despite legal requirements to do so for 13 critical stocks by 2024.

The very slow progress in completing rebuilding plans and improving key performance indicators (such as reference points) indicates a lack of urgency and priority in implementing legislative and policy commitments, despite significant investments, policy improvements, and updated laws. Swift action is required to halt the declining trends in our stocks' health and bring them back to more abundant levels, particularly in the face of growing threats brought on by climate change affecting ocean ecosystems and coastal communities.

The *Fisheries Act*, which underwent amendments in 2019, mandates the establishment of rebuilding plans for critically depleted stocks prescribed in regulation. In April 2022, the Fishery (General) Regulations were revised to outline the required content for these plans (Government of Canada, 2022; DFO, 2022a, 2022b) and prescribed the initial set of stocks designated for regulatory action. The list comprises 30 major fish stocks, nearly half of which are in a critical state. Consequently, rebuilding plans must be developed and implemented within 24 months, with a 12-month extension possible if necessary.

Other progressive fishing nations that adhere to globally accepted fisheries management standards have successfully rebuilt stocks by implementing robust plans (Archibald and Rangeley, 2019c; Levesque et al., 2021; NOAA, 2021). For example, the U.S. has successfully rebuilt 49 stocks since 2000 and has rebuilding plans in place for 84 per cent of its overfished stocks (NOAA, 2022), resulting in more resilient ecosystems and greater economic opportunities for the fishing industry. In Europe, the reformed Common Fisheries Policy and recovery plans have aided in the recovery of hake, plaice, anchovy by prescribing an end to overfishing and mandating rebuilding. Canada's slow progress in

implementing rebuilding plans, coupled with the large number of uncertain stocks, could perpetuate declines, and increase both ecological and socioeconomic risks (Archibald et al., 2021a; Archibald and Rangeley, 2021a).

Over 80% of critically depleted fish stocks are in the Atlantic Ocean, serving as a stark reminder of the lasting impact of intense historic overfishing and the inadequacy of measures taken to address this issue over the years. Many high trophic level groups, such as groundfish and flatfish, have yet to recover from collapses in the 1990s, which were primarily caused by unsustainable high levels of harvesting and unfavorable environmental conditions (ECCC, 2020). The depletion and near elimination of older, larger individuals, led to increased reliance on fisheries for lower trophic level species, such as high value invertebrate stocks like snow crab and shrimp. Moreover, the current alarming absence of healthy forage fish, like herring and capelin, poses significant risks, as it threatens to disrupt food web structure, function, and biodiversity recovery—a trend also observed on the Pacific coast. Decades of heavy exploitation and serial failures of management to reduce quotas to sufficient levels to allow rebuilding has culminated in socioeconomic instability and jeopardised Canada's reputation internationally (Winter and Hutchings, 2020; Godwin et al., 2023).

There have been some positive developments with certain groups of species like Pacific rockfish and Atlantic redfish, where favorable environmental conditions and effective management measures have facilitated population growth. The Acadian and deepwater redfish stocks in management Units 1 and 2 have rebounded from critical levels in the past six years (DFO, 2019e), resulting in increased quotas for the experimental fishery in Unit 1 and highlighting the effectiveness of conservation measures in supporting recovery. This year, Fisheries and Oceans Canada (DFO) has committed to work with stakeholders, including five Indigenous groups, to finalize the plan for a commercial fishery through the Redfish Advisory Committee (RAC); however, any such plan must address measures to support growth of the less abundant deepwater species, as well as limit bycatch of depleted stocks and undersized redfish. Recent growth of Pacific shrimp stocks has reached levels that could support fishing opportunities while also providing food for economically important stocks like hake and halibut. However, bycatch of culturally and ecologically important forage fish like eulachon remains a concern, in addition to the benthic impacts of trawling gear (Fisheries and Oceans Canada, 2023). To ensure sustained recovery of Pacific shrimp, while supporting ecosystem needs, DFO must continue to adhere to the precautionary approach and science-based advice.

While some progress has been made in applying key policies on fisheries science and management, certain areas still present significant challenges. Positive developments include an increase in stocks with upper reference points, improved mortality estimates, climate change considerations, and enhanced transparency through Integrated Fisheries Management Plans. However, over a third of stocks still lack limit reference points, and management decisions are often made without providing public with evidence-based rationale. Additionally, the proportion of stocks with recent stock assessments has been consistently declining since 2020 and estimates of total mortality and exploitation rates remain low. Increased investments in fisheries science will likely be necessary to expedite the implementation of fundamental requirements for management.

Monitoring of fish catches both on the water and at landing sites is necessary to support rebuilding, and persistent data gaps in this audit emphasizes the need for improved tracking and reporting of fish removals from the ecosystem. Although Canada introduced the Fishery Monitoring Policy in 2019 to account for all catches in a fishery, it has yet to be completely implemented for a single fishery. Implementation of the national Fishery Monitoring Policy is essential for rigorous fisheries management and decision-making, providing critical information to managers. It should be enforced across all fisheries with allocated resources and deadlines (Oceana Canada, 2023). The success of the *Fisheries Act* amendments and regulations intended to rebuild and sustainably manage fisheries relies on better data.

Human-induced climate change is disrupting the stability of ocean conditions, threatening many marine species. This past year, the world's oceans were the warmest on record for the fourth year in row (Cheung et al., 2023). Oceans have absorbed 90% of the excess heat from greenhouse gas emissions, endangering 87% of 25,000 marine species if emissions are not reduced (Boyce et al., 2022; Cheung et al., 2023). The impacts of climate change on marine species are increasingly evident both directly and indirectly, affecting species distributions and ecosystem communities (Boyce et al., 2021; DFO, 2019a, 2020a; Lam et al., 2016; Talloni-Álvarez et al., 2019; Wilson et al., 2020). As a result, numerous species in Canadian waters are moving toward the Arctic, replacing native species in a process known as Atlantification and Pacification (Ingvaldsen et al. 2021; Katz, 2018). Coastal fisheries are experiencing new or exacerbated conflicts over access and rights (Vogel et al., 2023), while facing socioeconomic consequences of more frequent and extreme marine heatwaves and stronger storms (McDonald, 2023). DFO's inadequate incorporation of evidence of climate change into its management and scientific practices hinders the establishment of adaptive and resilient management systems. (Pepin et al., 2022; Schijns and Rangeley, 2022a).

Climate change and overfishing combined are depleting or otherwise disrupting many populations commercially harvested in Canada. But we know that when the effects of climate change are explicitly considered in managing fish stocks, stocks perform better and fishery-related conflicts are reduced (Cheung et al., 2022; Vogel et al., 2023). To address these challenges, it is crucial to gather monitoring data on populations and their environment, understand species responses to ecosystem dynamics, and incorporate this knowledge into adaptive fisheries management. DFO's commitment to adopting an ecosystem approach to fisheries management holds the potential to revolutionize the field, but urgent action is needed to strengthen population resilience by minimizing cumulative impacts, mitigating the impacts of climate change on marine ecosystems, and adopting climate-adaptive and conflict-resilient frameworks (Boyce et al., 2023; Cheung et al., 2022).

The status quo of Canadian fisheries management is currently unreconcilable with commitments and desired outcomes for social justice, fisheries sustainability, and ecosystem resilience (Paul, 2022; Oceana Canada, 2023). Shifting to a more holistic approach by pairing Western science and Indigenous Knowledge Systems (IKS) enhances fisheries management by fostering collaboration and complementing methodologies and technologies with designing adaptive management practices that account for long-term ecosystem-level processes and the interrelationships between species and spaces (Frid et al., 2023). Fisheries guided by IKS principles govern people to "take only what you need and leave lots for the ecosystem" (Reid et al., 2022), which promotes greater abundances, larger body sizes, older age

structures, and more resilient food webs. Unfortunately, existing policies under the Sustainable Fisheries Framework are largely exclusive of IKS (Frid et al., 2023). Intentional or not, that exclusivity does not align with the *United Nations Declaration on the Rights of Indigenous Peoples Act* Action Plan (Department of Justice Canada, 2023), DFO's Reconciliation Strategy[1] or the Government of Canada's commitments outlined in "Principles respecting the Government of Canada's relationship with Indigenous peoples."[2], as well as recent agreements between Indigenous, federal, and provincial governments (FRRA, 2021; MPA Network BC Northern Shelf Initiative, 2023). These agreements are setting a precedent and building a legal landscape that could allow collaborative fisheries management to become inclusive of and compatible with IKS and Two-Eyed Seeing[3] if supported by appropriate policies and management practises (Reid et al., 2021; Frid et al., 2023). A new era of collaborative fisheries management could contribute meaningfully to reconciliation and sustainability of marine ecosystems.

Canada has both national and global commitments to steward its wild fisheries responsibly and ensure a low-carbon, high protein source of food for the world's growing population. By implementing the new Fishery (General) Regulations (hereafter referred to as the rebuilding regulations) under the *Fisheries Act*, the government has an opportunity to rebuild healthy fish populations, build ecosystem resilience to climate change and advance social justice. To seize this opportunity the government must continue to make investments in fisheries science, list all stocks under the *Fisheries Act*, fully implement fisheries monitoring, and engage in meaningful collaboration with rightsholders and stakeholders (Archibald and Rangeley, 2019c; Levesque et al., 2021; NOAA, 2021). By working together, we can rebuild abundant fish populations that can support communities and help feed the world.

Recommendations

Canada must modernize fisheries management to be adaptive to climate change, support fisheries sustainability and fulfill its obligations to reconciliation with Indigenous Peoples. The government needs to match its response to the urgency of the state of our fisheries. Key recommendations have been informed by seven years of Oceana Canada's Fishery Audits, tracking the government's progress on fisheries management. In addition, Oceana Canada's symposium in October 2022, *Rebuilding Abundance: Priorities for a Resilient Ocean*, and workshops on Indigenous Priorities for Canadian Fisheries Rebuilding (Paul, 2022; Oceana Canada, 2023) identified broad consensus on recommended changes to priorities, policies and practices.

At a minimum, Canada must:

1. **Prescribe all remaining stocks to the Fish Stocks provisions in the *Fisheries Act* by 2024 and make management decisions that are consistent with the law.** Canada's *Fisheries Act* requires that DFO develops rebuilding plans for all depleted fish stocks prescribed under new *Fisheries Act* regulations. To date, these regulations only apply to the 30 stocks added under the Fish Stocks provisions (FSP). All federally-managed stocks must be listed in upcoming batches. Specifically, DFO must:

[1] Available at: https://www.dfo-mpo.gc.ca/fisheries-peches/aboriginal-autochtones/reconciliation-eng.html
[2] Available at: https://www.justice.gc.ca/eng/csj-sjc/principles-principes.html
[3] A term coined by Mi'kmaw Elder Albert Marshall to encapsulate the pairing of Indigenous and Western knowledge systems in ways that meaningfully embrace pluralism and social justice (Reid et al., 2021).

   a. Implement ten new rebuilding plans and three revised rebuilding plans by April 2024 as required by the Fish Stocks provisions;
   b. Prescribe all remaining critical and cautious stocks to the Fish stocks provisions by April 2024 and implement rebuilding plans for those stocks by 2026;
   c. Include all remaining fish stocks in regulations by December 2024; and
   d. Assign status and Limit Reference Point (LRP) for all uncertain stocks, prioritizing 16 key stocks (See Table 3 in Schijns and Rangeley, 2022b) by December 2024.
2. **Manage fisheries based on the best available science and Indigenous Knowledge Systems (IKS):** To uphold its commitments to reconciliation, the Canadian government must strengthen policy and practices to include an IKS approach. Specifically, DFO must:
   a. Revise the suite of policies under the Sustainable Fisheries Framework, namely the Precautionary Approach policy, to be inclusive of IKS;
   b. Codify how Indigenous Knowledge Systems are applied in fisheries management through Indigenous-led guidelines and publishing objectives in annual work plans;
   c. Implement collaborative fisheries management agreements between the Canadian government and Indigenous organizations;
   d. Provide predictable, consistent and flexible funding to ensure Indigenous partners have the capacity to conduct and monitor marine stewardship activities; and
   e. Increase habitat protection through collaborative ecosystem-based fisheries management and IKS contributions to local stewardship.
3. **Account for climate change effects to marine ecosystems:** DFO must assess the vulnerability of stocks to climate change and incorporate them into management decisions as well as consider ecosystem impacts. Specifically, DFO must:
   a. Include a new section in DFO Science Advisory Reports or related documents titled "Climate Change Considerations" that explicitly summarizes vulnerability and climate risk, available knowledge on ecosystem changes and the mechanisms for including relevant information in fisheries science;
   b. Ensure consistent consideration of climate change effects in fisheries management decisions by integrating environmental variability into assessments and risk-based advice;
   c. Adopt an Ecosystem Approach to Fisheries Management (EAFM), focusing on long-term ecosystem management and recognizing the ecological and cultural significance of fish beyond their economic value; and
   d. Implement management decisions and strategies for forage fish that account for their role in the ecosystem, aligning with the Policy on New Fisheries for Forage Species (DFO, 2009b).
4. **Count everything caught in a fishery** — including for recreational and bait purposes — and account for all sources of fishing in management decision-making. DFO must accelerate efforts to modernize fisheries monitoring including a transition towards electronic reporting and monitoring technologies that record all catch. Specifically, DFO must:
   a. Increase the following efforts to implement the Fishery Monitoring Policy to ensure all federally-managed fish stocks and fisheries have sufficient monitoring coverage to provide dependable estimates of fishing mortality from all sources:

i. Provide dedicated operating resources to implement the policy over the next five years to ensure all federally managed fish stocks and fisheries have their monitoring programs reviewed under its standards;
ii. Advance monitoring activities identified in the Sustainable Fisheries Framework Work Plan, prioritizing stocks with insufficient data and monitoring protocols, and including at least five stocks for complete implementation in each DFO Region every year until the policy has been implemented for all major stocks; and
iii. Publish an annual report to the Minister that evaluates progress toward achieving the policy objectives for all major stocks, along with targets and timelines for nationwide implementation.

To address these high-level priorities, Oceana Canada calls on DFO to accelerate the key actions outlined in the Audit. This includes fulfilling commitments in Canada's Sustainable Fisheries Framework and those that have been delayed[4] from previous work plans, as well as those scheduled to be completed this fiscal year.

Background

Canada's marine fisheries are highly valuable: they are a major driver of our economy, shape our culture, and sustain our coastal communities. Canada has a fisheries policy framework in place that establishes a precautionary approach and provides a basis for considering ecosystem approaches to fisheries management as is stated by the *Fisheries Act* (DFO, 2009c). Many policy instruments have not been fully implemented or updated to reflect best practises, putting our fisheries and fishing communities at risk (Archibald et al., 2021a; Baum and Fuller, 2016; CESD, 2016; Hutchings et al., 2012; Hutchings et al., 2020; Winter and Hutchings, 2020). The consistent application and innovation of these policy tools will be essential to ensure the stability of healthy fisheries and the best chance of rebuilding depleted stocks for the benefit of marine ecosystems, coastal communities, and the fishing industry.

In 2017, Oceana Canada published its first annual Fishery Audit, evaluating the status of Canada's fisheries and providing an assessment of how the government is managing them (Oceana Canada, 2017). The Fishery Audit 2017 built upon a 2016 report commissioned by Oceana Canada (Baum and Fuller, 2016) to develop indicators that measure progress toward maintaining or rebuilding fisheries to healthy levels in Canada and to track how well DFO is implementing its commitments from year to year. These indicators represent the basic and essential information required for sustainable management of our marine fish and invertebrate stocks (Archibald et al., 2020; Archibald and Rangeley, 2017, 2018, 2019b, 2021b; Schijns and Rangeley, 2022c). The current report uses newly available information published over the last year to update the status of Canada's marine fish and invertebrate populations and examine changes in indicators, demonstrating the extent of progress made by DFO towards rebuilding healthy and abundant oceans.

Indicators to measure progress towards healthy fisheries in Canada

The indicators are summarized as follows:

[4] There were 31 activities that were not completed in the Sustainable Fisheries Framework Work Plan for Fiscal 2022-2023 and were carried forward to the Sustainable Fisheries Framework Work Plan for Fiscal 2023-2024 (DFO, 2023a).

1. **Status:** The number and percentage of stocks in the healthy, cautious, and critical health status zones and the number and percentage whose health status is uncertain (DFO, 2009a). This information is essential to determine and prioritize management actions, including determining where rebuilding plans are most needed. This indicator provides a snapshot of the overall health of Canada's marine fish and invertebrate stocks.

2. **Stocks whose health status has shifted from uncertain to certain (or vice versa):** The number of stocks whose health status was previously unknown or uncertain that can now be confidently assigned a status. This indicates how much of the reported changes are due to having better information available. As DFO continues to develop reference points and improve stock assessments, the number of stocks with an uncertain status should decline. However, sometimes assessment methods change or new information comes to light, creating situations where the reverse occurs, so this report also includes the number of stocks where the health status has become uncertain.

3. **Change in status:** The number and percentage of stocks whose health status improved, worsened, or stayed the same. This indicates how stock states have changed since the previous year. Over time, with the success of fisheries rebuilding efforts, more stocks should move out of the critical and cautious zones and into the healthy zone.

4. **Biomass/abundance known:** The number and percentage of stocks with biomass/abundance estimates that are no older than five years. This indicator shows how many stocks have recent estimates of abundance and how this number changes from year to year. Given the federal government's increased investment in science capacity since 2016 and the hiring of more scientists (Government of Canada, 2018; Hutchings, 2016; Oceana Canada, 2018b), this number should increase over time. Most full, peer-reviewed stock assessments are now conducted on a multi-year cycle (e.g., every 2–5 years), but monitoring continues for many stocks on an annual basis. To meet the need for advice in interim years between complete assessments, scientists often provide interim-year updates on the status of the stock based on pre-identified indicators (DFO, 2016b). During interim updates, indicators are evaluated against predetermined thresholds. If the indicators cross those thresholds, pre-defined management actions may be implemented or a full assessment may be required earlier than scheduled (DFO, 2016b). For stocks not assessed recently, the present Oceana Canada report gives the number and percentage of stocks with a recent interim update, indicating whether trends in proxies for biomass/abundance are being evaluated.

5. **Sources of mortality known:** The number and percentage of stocks that have an estimate of fishing mortality, natural mortality, and total mortality, as estimated by models. Fish are removed from a population due to natural causes and fishing. In terms of fisheries management, it is most important to know the fishing mortality rate (F). Ideally, estimates will include information from all potential sources of fishing mortality: directed commercial fisheries, recreational fisheries, bait fisheries, food-social-ceremonial fisheries, and bycatch (DFO, 2009a). One or more of these sources are often missing from fishing mortality estimates, and they may end up being included with an estimate of natural mortality.

Natural mortality (M) is the removal rate of fish from the population from causes not directly attributable to fishing. It can include disease, competition, cannibalism, old age, and predation but may also include catch that is unreported or unaccounted for. Most common stock assessment models assume natural mortality is constant and input it into the model using an informed guess. However, several approaches have been developed to estimate natural mortality within models that allow it to vary. The sum of fishing and natural mortality is termed total mortality (Z). In some mortality estimation approaches, only total mortality can be estimated. For some stocks, the data available or the most appropriate modelling approach simply does not allow for an estimation of all sources of mortality. For this reason, the present Oceana Canada report gives the number and percentage of stocks with exploitation rate index estimates.

An exploitation rate index is the proportion of the population removed by fishing. It can be expressed as a proportion of fish or biomass. It provides an indication of fishing pressure. Its calculation requires an estimate of biomass or abundance in the population. If this is unavailable, then managers should at least know how many fish are removed from the population due to fishing. To assess this, the present Oceana Canada report gives the number and percentage of stocks with landed volume reported in stock assessment documents. Combined, these indicators show what information managers are using to make decisions about fishing pressure on Canada's stocks. An increase in the number and percentage of stocks that have an estimate of fishing mortality, natural mortality, and total mortality from year to year will indicate that scientists have increased ability to estimate all sources of mortality for more stocks, due to more data and the ability to use the models required. As a result, managers will have more certainty in the outcomes of management decisions.

6. **Reference points:** The number and percentage of stocks that have health status benchmarks, such as limit reference points (LRPs) and upper stock reference points (USRs). Reference points define the stock health status zones, allowing an assessment of whether a stock is in healthy, cautious, or critical condition and providing the basis for rebuilding plan goals (DFO, 2009a). Reference points enable objective assessments of stock health and the success of management measures. With DFO's commitment to developing reference points for all major stocks (CESD, 2016; DFO, 2020d), the number of stocks with reference points should rise from year to year.

7. **Management plans in place:** The number and percentage of stocks included in an Integrated Fisheries Management Plan (IFMP), which is Canada's planning framework for the conservation and sustainable use of our fisheries (DFO, 2010). These plans outline in a single document the process by which a fishery will be managed over a given period. IFMPs are also an important tool for implementing departmental policies and the primary tool for managing stocks in the healthy and cautious zones and rebuilding stocks from the cautious to the healthy zone. A transparent, fully accessible, and detailed IFMP makes it easy to determine how a stock is managed, making it less vulnerable to bad decision-making. With DFO's commitment to develop and release IFMPs for all major stocks (CESD, 2016; DFO, 2020d), the number of stocks with IFMPs should rise from year to year.

8. **Catch monitoring:** The number and percentage of stocks with one or more of the following: at-sea observers/electronic monitoring, dockside monitoring of landings, logbooks that record the entire

catch, or electronic (i.e., satellite) vessel monitoring systems (VMS) that monitor the location and time of fishing activity. When fisheries have accurate estimates of how much of each species is caught, how much is discarded, and where and when fishing is occurring, DFO can make informed fisheries management decisions. These indicators assess how well the fisheries on our stocks are monitored. There are many ways to monitor the catch, but at-sea observers/electronic monitoring, dockside monitoring, and logbooks are among the most common tools. Each has some trade-offs. Dockside monitoring is a land-based program that monitors the weight and type of fish landed from a commercial fishing vessel when it returns to port. Although this is a good way to assess retained catches, it does not record species discarded at sea. At-sea observers and electronic monitoring (e.g., video) record the entire catch, both retained and discarded. However, 100 per cent coverage can be expensive and not necessary for all fisheries. The entire catch can also be recorded in logbooks, in which fishers record information about their catch and activities. However, it is not always a requirement to record all bycatch species, and catches identified using species guides may not be reported accurately. Electronic vessel monitoring systems allow scientists and managers to assess fishing effort in time and space using satellite technology, but this may not be feasible or required in all fisheries. By using a combination of catch monitoring tools, ideally recording the entire catch, fisheries scientists and managers will have the data required to effectively manage our fisheries.

With the release of a national Fishery Monitoring Policy in November 2019 (DFO, 2019c), more attention is expected from DFO to determine and ensure the appropriate type and frequency of catch monitoring in all our fisheries. One of the implementation steps is ensuring there are specific and measurable fishery monitoring objectives in all IFMPs, with monitoring requirements to achieve targets explicitly stated. To evaluate the implementation of the national Fishery Monitoring Policy, Oceana Canada reports the number and percentage of stocks with *specific and measurable* fishery monitoring objectives appearing in their IFMPs. These indicators should rise from year to year as the fisheries on these stocks evaluate and improve their catch monitoring.

9. **Critical stocks with rebuilding plans:** The number and percentage of critical-status stocks that have rebuilding plans. DFO follows a fisheries decision-making framework that incorporates the precautionary approach (PA) framework (DFO, 2009a). The precautionary approach means being cautious when scientific knowledge is uncertain and not using the absence of adequate information as a reason not to take action. According to the PA framework, all stocks within the critical zone must have rebuilding plans (DFO, 2009a). Similar to an IFMP, a rebuilding plan provides a framework for the management of a fishery, with additional requirements included to rebuild the stock out of the critical zone (DFO, 2009a, 2013), preferably to a healthy state. Ideally, all stocks in the critical zone should have rebuilding plans. Given DFO's commitments and updated law to reflect these commitments (CESD, 2016; Legislative Services Branch, 2019; DFO, 2020d), this indicator is expected to increase from year to year.

10. **Climate change considerations:** New indicators were added in 2022 to assess the number and percentage of stocks with climate change considered in formal fisheries science and management documents in comparison to the evidence available in the literature (Schijns and Rangeley, 2022a). The first indicator is based on the inclusion, mention, or absence of climate change effects in fisheries science and management documents (i.e. IFMP, stock assessment). The second indicator

determines whether there is supporting, limited, or no literature indicating that the species in question is experiencing climate change effects in the same or neighbouring region. Species vulnerability is also included based on external literature. By adding new indicators that evaluate the extent that climate is currently considered in fisheries management, compared to available scientific literature, we aim to highlight knowledge and application gaps for vulnerable species that require urgent and climate-adaptive management measures.

Methods

The initial Fishery Audit stock list (n = 194 stocks) was created for the 2017 Fishery Audit (for details on stock list creation, see Archibald and Rangeley, 2017). At the time, it was the most complete list of stocks available for Canada. It is based on marine fish and invertebrate stocks[5] included in the report commissioned by Oceana Canada in 2016 (Baum and Fuller, 2016), combined with those included in the first detailed release of the results of the DFO Sustainability Survey for Fisheries (SSF) (2015 results, released in October 2016; DFO, 2016e), with the addition of any stocks with newly available information from departmental reports that year. While the SSF is completed by DFO scientists and resource managers for the stocks in their regions, Oceana Canada's Fishery Audit stock list is closer to representing all marine fish and invertebrate stocks that are managed within Canada and are subject to targeted or incidental commercial fishing pressure than the SSF, which primarily includes major commercial stocks (DFO, 2016a),[6] but several minor stocks are still missing from the list.

There is no comprehensive list of all commercial fish stocks subject to federal management in Canada. In Oceana Canada's subsequent Fishery Audits (Oceana Canada, 2018a, 2019, 2020, 2021, 2022), efforts were made to continue to strive towards a comprehensive stock list by adding to the dataset any further stocks found in newly available information from departmental science reports, departmental work plans (DFO, 2017b, 2018b, 2019b, 2020e, 2021d, 2022d; 2023a), or new additions to the SSF (DFO, 2016e, 2022e; 2023b). However, to make comparisons from year to year, this report focuses only on stocks included in the 2017 stock list, which is now called the index stock dataset.

To update the information pertaining to the indicators, Oceana Canada reviewed DFO websites for published IFMPs and rebuilding plans and reviewed all Canadian Science Advisory Secretariat (CSAS) Science Advisory Reports, Research Documents, and Science Responses published since the last Fishery Audit (i.e., between July 2, 2022 and July 1, 2023). For stocks assessed by regional fisheries management organizations (RFMOs) and stocks jointly assessed by the U.S. and Canada, relevant websites were reviewed for newly available information. If newly available information did not result in an update to an indicator, values from 2022 were carried forward. A few minor errors found in previous records (e.g., assessment year based on publication date rather than last year of data used) were

[5] It does not include marine mammals, diadromous fish, or freshwater fish.

[6] The number of stocks included in the SSF has varied over time since the first release of stock-by-stock results in 2015 (n = 159 stocks in 2015; n = 170 stocks in 2016; n = 179 stocks in 2017; n = 177 stocks in 2018, n = 176 stocks in 2019, n=180 stocks in 2020). The most recent results (2021) of the SSF includes 180 stocks, of which 136 are marine fish and invertebrates and 45 stocks are marine mammals, diadromous fish, or freshwater fish (DFO, 2023b). These stocks represent most of the landings from fisheries managed by DFO but are just part of all the stocks managed by DFO. Stocks are selected for inclusion in the survey based on their economic, cultural, or environmental importance.

corrected when found during the 2023 update process. These minor errors did not change indicator values significantly, and annual comparisons are made using the corrected indicator dataset.

This year's report continues to measure the same indicators, and during the update process, information was interpreted in the same manner. See the previous reports for further details on how indicators are evaluated for each stock (Archibald et al., 2020; Archibald and Rangeley, 2017, 2018, 2019b; Schijns and Rangeley, 2022c). Briefly, the health status of each stock was updated. In some cases, Oceana Canada was able to find this information in the documents searched, using the biomass estimates in relation to reference points. In other cases, health status was assigned based on an interpretation of data included in the documents. In determining whether a stock had a recent biomass/abundance estimate (less than or equal to five years old), the last year of data included in the assessment was used to determine how recently the estimate was made. This reduced the confusion from the long time-lapse (i.e., years) that sometimes occurs between when assessments are conducted and when the results are published (Archibald et al., 2021b). Additionally, only complete assessments (e.g., from CSAS national or regional peer review processes) with a new biomass (or proxy) estimate were accepted as an assessment; interim updates of indicators (e.g., from CSAS science response processes) were not because they are most often based on trends in survey and catch data and usually do not include biomass estimates expressed in relation to reference points (DFO, 2016b). However, the year of the most recent interim update process (i.e., CSAS science response process) was recorded for each stock. This information is used to calculate the number and percentage of stocks with an interim update since the last complete assessment, indicating whether trends in proxies for biomass/abundance are being evaluated in the absence of recent complete assessments.

In 2017, the only source of mortality included in Oceana Canada's Fishery Audit was fishing mortality. Natural and total mortality rates were added in 2018, and values were informed by the most recent stock assessment documents available for all stocks. Estimates of fishing mortality should ideally include information from all potential sources (e.g., directed commercial fisheries, recreational fisheries, bait fisheries, food-social-ceremonial fisheries, and bycatch) (DFO, 2009a). Therefore, in 2019 Oceana Canada began recording when stock assessment reports clearly indicated all sources were incorporated in the fishing mortality estimation. However, there are stocks where a lack of data or the modelling approach used by scientists simply does not allow for an estimation of fishing mortality, natural mortality, or total mortality. In such cases, Oceana Canada simply recorded whether exploitation rates, exploitation rate indices, or relative fishing mortality rates (i.e., catch/survey biomass) were estimated. Similarly, because the calculation of exploitation rate requires an estimate of biomass or abundance in the population, which is not always available, it was also noted whether the volume of landings was available in assessment reports.

The language describing reference points can be ambiguous in CSAS documents. Terms such as "calculated" or "proposed" are often used with little indication as to whether the reference points have been accepted and implemented. For the purposes of this Fishery Audit, Oceana Canada concluded that stocks had reference points if there was any indication of them having been developed but not if there was a clear indication in the reports that they were not yet accepted or implemented by managers. In the case of stocks assessed by RFMOs, if reference points exist, they often have different criteria and definitions of health status zones and reference points than DFO's PA framework. If information on these stocks included the biomass relative to a biomass limit reference point (B_{LIM}) or the biomass at

maximum sustainable yield (B_{MSY}), this information was used to assign a status zone analogous to DFO's PA framework (e.g., if the currently assessed biomass was less than B_{LIM} or less than 40 per cent of B_{MSY}, the stock was assigned to the critical zone). Similarly, if there was a B_{LIM} indicated, it was considered an LRP. Additionally, for some stocks no longer subject to a directed commercial fishery, DFO appears to be developing biomass recovery targets instead of reference points. Although recovery targets should be developed to rebuild healthy populations (i.e., above an equivalent USR), DFO often, confusingly, uses definitions like those used for LRPs (i.e., 40 per cent B_{MSY}) (e.g., Swain et al., 2016). Thus, in these cases, biomass recovery targets developed by DFO were considered analogous to LRPs.

It is not unusual for more than one fishery to catch a given stock, making assessments of catch monitoring challenging. For example, different fisheries catching the same stock may have different targeted levels of at-sea observer coverage that varies by gear type and/or vessel size. Therefore, Oceana Canada established indicator values broad enough (e.g., complete coverage, varying levels of coverage, uncertain if tool is used) to allow for an amalgamation of values, but available details on targeted levels of tool use were recorded in brackets within the indicator value for each stock in the indicators spreadsheet. If there was no indication in the documents and websites searched that the use of the monitoring tool is required, "uncertain" was assigned as the indicator value. "No" was only assigned when it was clearly indicated the tool was not used. In 2019, the requirement to use electronic VMS or an automated identification system (AIS) was added to the existing three commonly used catch monitoring tools evaluated in previous reports (see Archibald and Rangeley, 2017, 2018). Further, in anticipation of the finalization and implementation of the national Fishery Monitoring Policy, the number and percentage of stocks with specific and measurable fishery monitoring objectives appearing in their IFMPs was recorded starting in 2019. To meet this requirement, objectives had to be clearly stated as fishery monitoring objectives, with the purpose stated, and details the policy suggests should be included, such as the tools, targeted coverage levels, and acceptable level of dependability to meet the objective.

In 2020, the indicators of stock status and whether a stock was recently assessed or not were explored in relation to proxies for recent landed volume and value (Archibald et al., 2020). This was done to characterize stock status in relation to these two proxies of economic importance and to determine if their economic importance influences stock assessment priorities. This analysis was not repeated since 2020, but the information required was collected and updated in 2023 and is available in the indicators spreadsheet, available online (Oceana.ca/FisheryAudit2023). Volume of reported landings for each stock was obtained from their most recent stock assessment reports. Stock assessment reports are the only location where publicly available landings data are reported by stock consistently across species and regions. Because Oceana Canada used this data as a proxy for economic importance, any estimates of unreported landings or discard mortality were excluded, as were non-Canadian landings when possible. Sometimes the volume of reported landings obtained represented a recent annual average if the most recent year was not reported by itself, and sometimes the volume found was out of date if the most recent report itself was dated. For these reasons, landed volumes reported in the spreadsheet should only be considered a proxy for recent harvest volume. Value is also not reported publicly by stock across all regions in a consistent manner. However, DFO does report annual aggregate national value data by taxa group and province on its Seafisheries Landings website (DFO 2016c). A proxy for recent landed value for each stock was estimated by multiplying the volume of reported of landings (in metric tonnes) obtained from reports by the most recent value per metric tonne of the taxa group and region to which

the stock belongs in the DFO Seafisheries Landings website dataset (DFO, 2016c). The value per metric tonne was calculated by dividing the value per taxa group and region (Atlantic or Pacific) in the most recent year reported (2021 for 2023 Fishery Audit indicators spreadsheet records) by the quantities per taxa group and region in the same year. Given that the taxa level reported on the Seafisheries Landings website differ in resolution and that actual ex-vessel prices differ by quality, region, and time of year, this value should only be considered as a proxy for recent value of reported landings.

With the seventh annual update of Oceana Canada's indicators, there are now sufficient data points for most indicators to be statistically evaluated for annual trends. Annual trends in the proportion of stocks with "yes" values for indicators (or the proportion within each stock status zone) were evaluated where appropriate using chi-squared tests with an alpha level of 0.05 (prop.trend.test function in the "stats" package; R Core Team, 2019).

Results and Discussion

The 2023 index stock dataset for this Fishery Audit includes 194 marine fish and invertebrate stocks that are managed within Canada and subject to targeted or incidental commercial fishing pressure (Table 1). The complete dataset of stocks and stock-specific indicator values is available online in the indicators spreadsheet (see Oceana.ca/FisheryAudit2023).[7] For a visualization of most indicators by DFO administrative region, see Appendix 1 of this document.

1. **Status:** In 2023, only 28.4 per cent (55 stocks) of Oceana Canada's marine fish and invertebrate index stocks can be confidently considered healthy. An additional 18.0 per cent (35 stocks) are in the cautious zone and 14.4 per cent (28 stocks) are in the critical zone, while the status of 39.2 per cent (76 stocks) is uncertain. Over the last seven years there has been little change in the overall status of the Canadian marine fish and invertebrate stocks evaluated (Figure 1, Table 1). There were no significant trends in the proportion of stocks considered healthy ($p = 0.21$ $\chi^2 = 1.55$), cautious ($p = 0.94$ $\chi^2 < 0.01$), critical ($p = 0.15$ $\chi^2 = 1.90$), or uncertain ($p = 0.93$ $\chi^2 < 0.01$) across years.

[7] In 2023, Oceana Canada continued its efforts to build a comprehensive stock list by adding to the dataset any additional stocks found during this update using newly available information from DFO reports, work plans, or new additions to the SSF (see Methods section). This resulted in a dataset that grew from 229 stocks in 2021 to 230 stocks in 2022, with no new stocks identified in 2023. Results calculated using all stocks did not differ greatly from those using index stocks, and results using all stocks are available in Table 2.

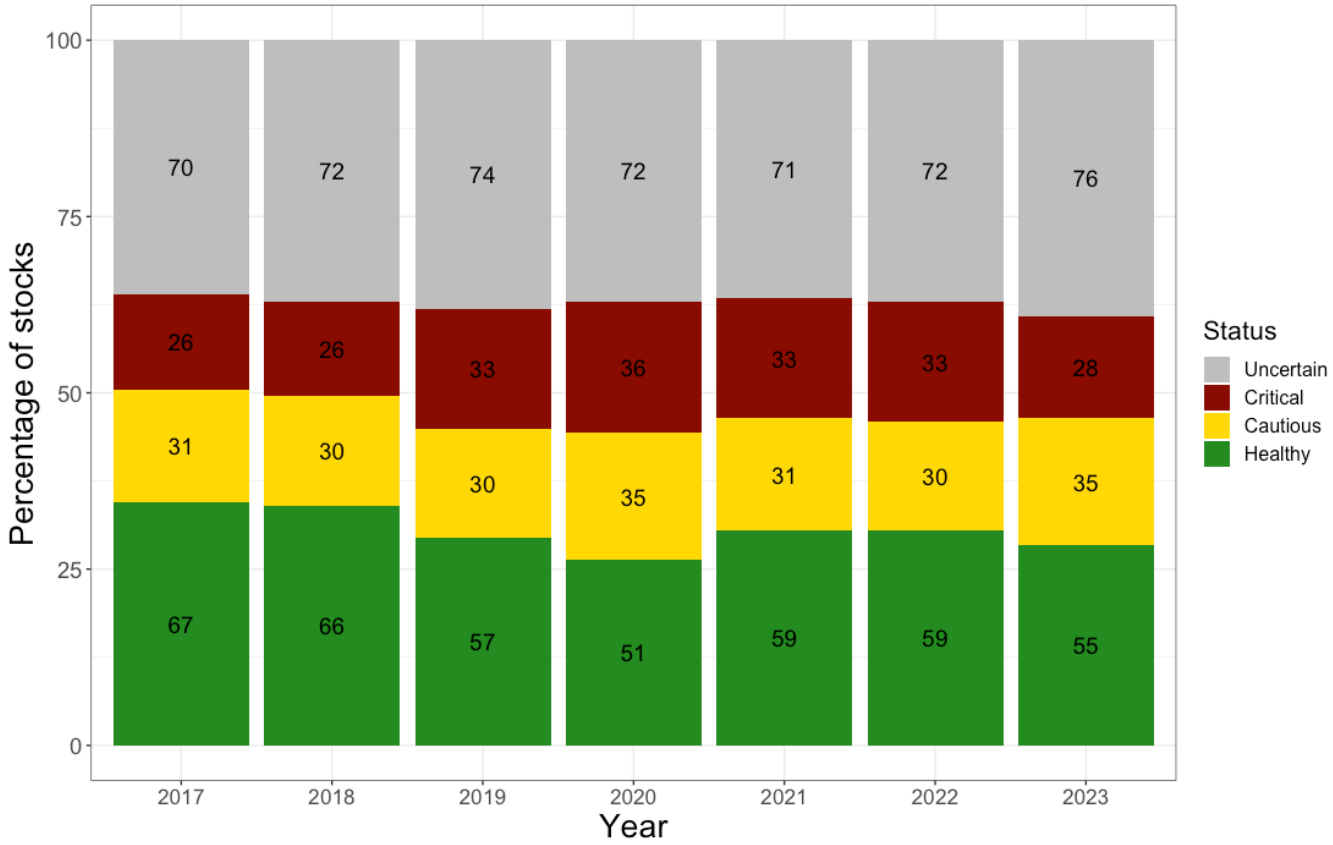

Figure 1. The percentage of Oceana Canada index stocks in each of the health status zones described in DFO's precautionary approach (PA) framework (DFO, 2009a) from 2017 to 2023. The number of stocks in each status zone is indicated in black font within the bars.

Most of the critically depleted stocks are groundfish (12 stocks) and flatfish (6 stocks) located in the Atlantic Ocean (Figure 2), many of which have not recovered since the groundfish collapse in the mid-1990s. There are also critically depleted invertebrate stocks (4 stocks) in the Pacific (Figure 3). Notable changes across the time series include the disappearance of healthy forage fish in both the Atlantic and Pacific (Figures 2 and 3). The health status of rockfish and redfish in the Pacific continues to improve every year (Figure 3) while, unfortunately, in both Pacific and Atlantic regions the status of many invertebrates, sharks and skates remain uncertain. Within the limited number of Arctic Ocean stocks included in the dataset, all but one stock is evaluated as healthy (Figure 4).

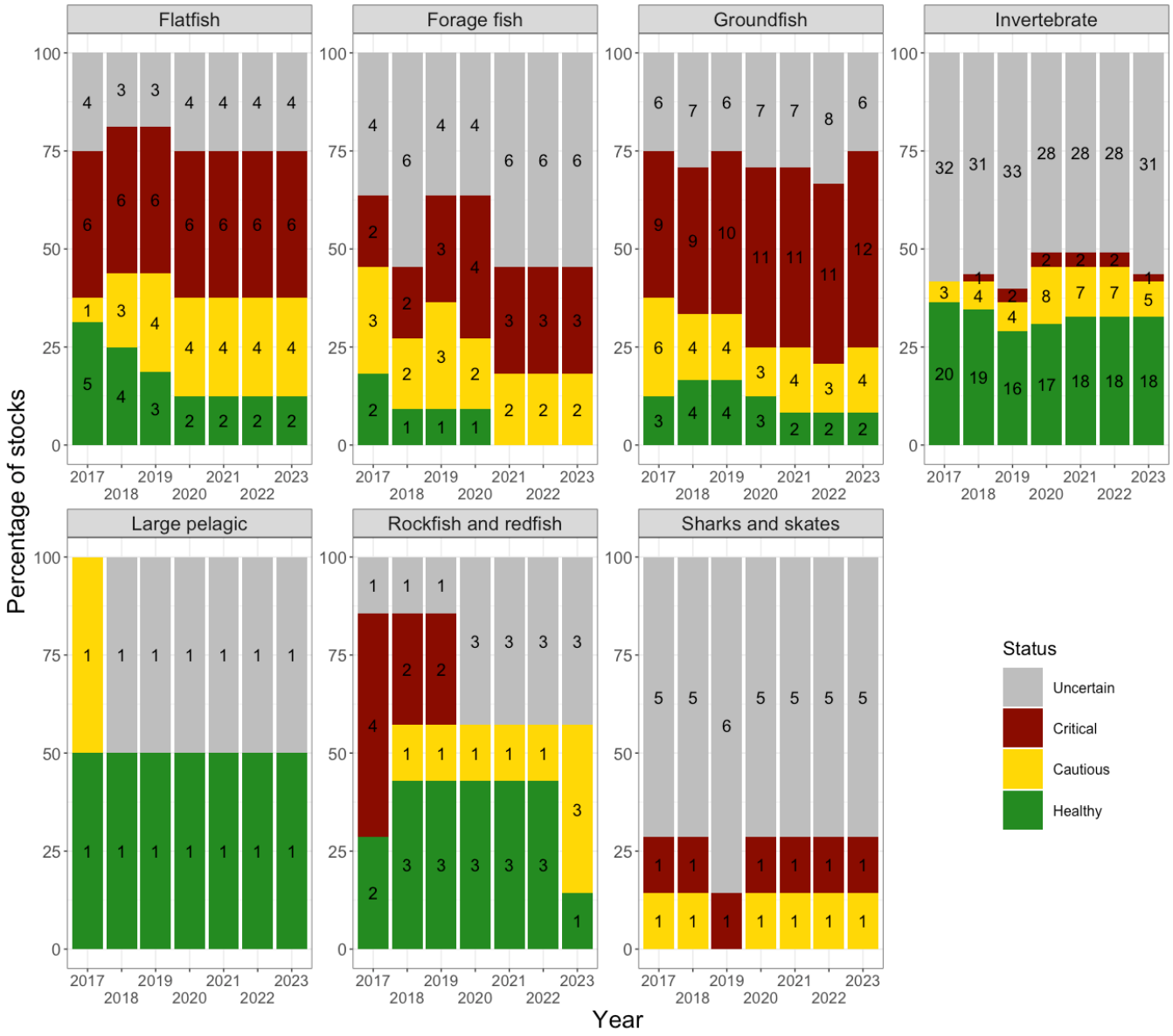

*Figure 2. The percentage of Oceana Canada index stocks in each of the health status zones described in DFO's precautionary approach framework (DFO, 2009a), by taxa groups, in the **Atlantic Ocean** from 2017 to 2023. The number of stocks in each year-taxa-status combination are reported in black font within the bars.*

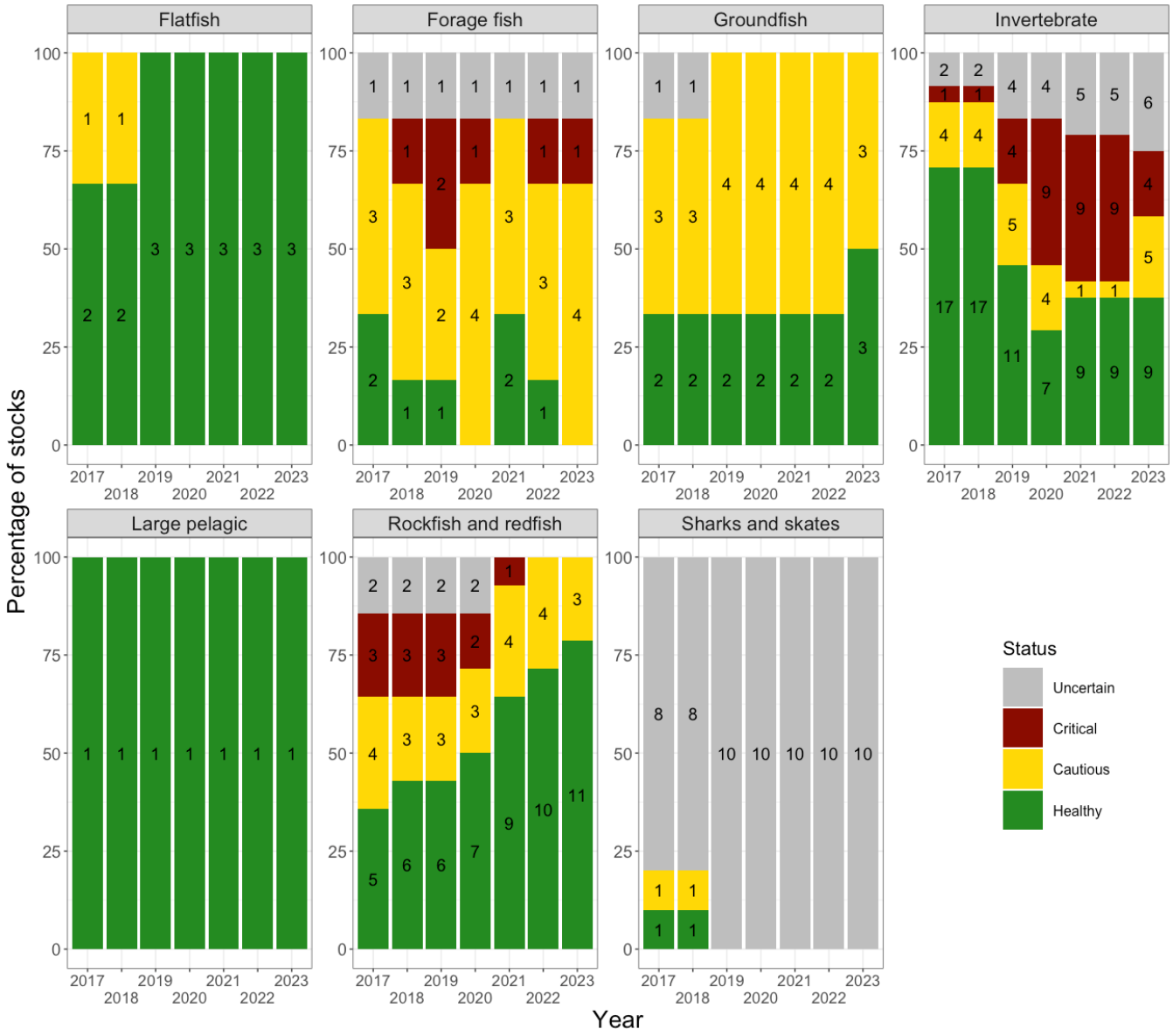

*Figure 3. The percentage of Oceana Canada index stocks in each of the health status zones described in DFO's precautionary approach framework (DFO, 2009a), by taxa groups, in the **Pacific Ocean** from 2017 to 2023. The number of stocks in each year-taxa-status combination are reported in black font within the bars.*

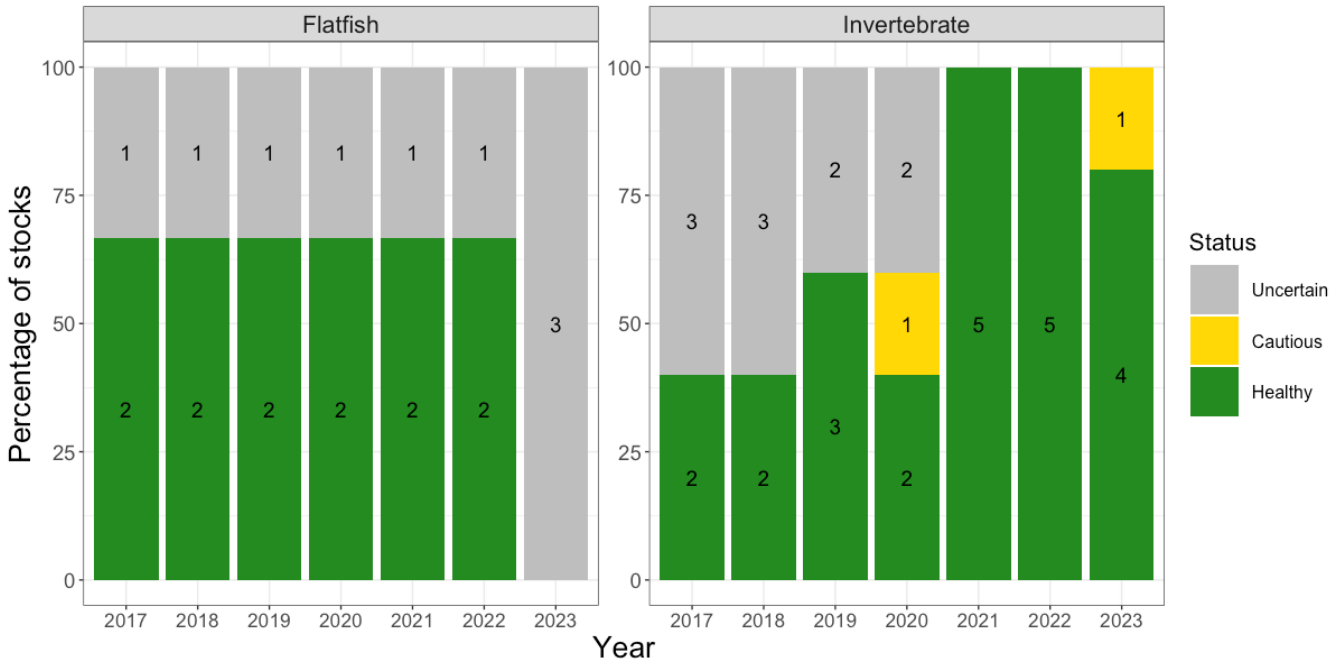

*Figure 4. The percentage of Oceana Canada index stocks in each of the health status zones described in DFO's precautionary approach framework (DFO, 2009a), by taxa groups, in the **Arctic Ocean** from 2017 to 2023. The number of stocks in each year-taxa-status combination are reported in black font within the bars.*

The 2023 status results reported here are slightly different from the most recent (2021) results of the DFO SSF, where 11.5 per cent (22 stocks) were critically depleted, 14.1 per cent (27 stocks) were in the cautious zone, 34.4 per cent (66 stocks) were in the healthy zone, and the status of 40.1 per cent (77 stocks) were uncertain (DFO, 2023b). These differences are likely due in part to the inclusion of additional taxa in the SSF (e.g., freshwater and diadromous fish) not included in the Oceana Canada index stock dataset, which focuses on marine fish and invertebrates that live their entire life cycle in the ocean. The differences are also likely due in part to the delay in the SSF; given it takes nearly a year to conduct and analyze the survey, results are reporting on the previous year's data and released over a year or more after the survey year (i.e., 2021 results were released in 2023).

The 2023 health statuses reported here are based on information available up to and including July 1, 2023, and are therefore informed by more recent information that was not available when the 2021 SSF was completed. Additional differences likely arise from differences in stock definitions and inclusion. Oceana Canada's index stock dataset was created from a merger of stocks included in the Baum and Fuller (2016) report and the 2015 SSF (DFO, 2016e), with stock definition discrepancies decided by the unit used in the most recent CSAS report (see Archibald and Rangeley, 2017 for details). Oceana Canada's index stock dataset is closer to representing all marine fish and invertebrate stocks that are managed within Canada and are subject to targeted or incidental commercial fishing pressure than the SSF, which contains primarily economically important stocks (DFO, 2016a). Therefore, although the index dataset used here includes all stocks from the SSF at the time it was first published, it also includes several stocks (47 stocks)

not included in the 2021 SSF in any form. Of these stocks not overlapping with the 2021 SSF stock list, ten are in the critical zone (21.3 per cent), six are in the cautious zone (12.8 per cent), five are in the healthy zone (10.6 per cent) and 26 are uncertain (55.3 per cent). This indicates the health of stocks that DFO considers "minor" may be worse than those it considers "major," contributing to the differences in health status reporting. Further research on the ecological, cultural, and economic values of rebuilding "minor" stocks is needed, particularly in light of the new rebuilding regulations, which only apply to prescribed "major" stocks.

Unlike Oceana Canada's dataset, where little change was found in in the overall status of index stocks from 2017 to 2023, the SSF dataset is showing a large decline in the percentage of what DFO considers to be healthy stocks from 49.1 per cent (78 of 159 stocks) in 2015 to 34.4 per cent (66 stocks of 192 stocks) in 2021. Given there was relatively little change in the percentage of stocks considered to be in the cautious zone (17.6 per cent in 2015 to 14.1 per cent in 2021) or critical zone (11.9 per cent in 2015 to 11.5 per cent in 2021), it seems this large change in the percentage with healthy status could be linked to the large increase in uncertain status stocks, from 21.4 per cent in 2015 to 40.1 per cent in 2021, as well as the addition of 33 new stocks to the survey. The SSF questions to DFO scientists and resource managers have changed since 2015 and have required respondents to provide more details and evidence in support of status determinations, including specifying if it is based on peer-reviewed evaluation or expert opinion (DFO, 2018c, 2021c, 2022d, 2023a). This may have resulted in respondents being more conservative in their evaluation of status. However, respondents indicated that serious harm was possible or likely for over a third of stocks with uncertain status (40.3 per cent or 31 of 77 stocks).

2. **Stocks whose health status has shifted from uncertain to certain (or vice versa):** In 2023, two index stocks went from having an unknown/uncertain status in 2022 to having one assigned due to new information (Table 1). Six stocks have been reclassified as uncertain, from five healthy and one critical. This resulted in a net increase in the total number stocks with uncertain status from to 72 in 2022 to 76 In 2023 (Table 1, Figure 1). While the number of uncertain status stocks in the Audit index dataset has remained relatively stable (between a minimum of 70 stocks in 2017 and a maximum of 74 in 2019) the number of uncertain stocks in the DFO SSF has increased greatly, from 34 stocks in 2015 to 77 in 2021 (DFO, 2016e, 2023b). DFO indicates uncertain status can be assigned for several reasons, such as a lack of reference points, insufficient data, or fluctuations in population level that makes assigning a health status difficult (DFO, 2016d). This lack of sufficient information to reliably assess the health status of some stocks, combined with the increase in the number of stocks included in the SSF, has contributed to the high number of stocks with an uncertain status in the SSF (ECCC, 2021). This increase is unexpected, given the continued development of reference points and improved science capacity for stock assessments within the department in the last seven years and given that the Oceana Canada index dataset shows little net change in the number of stocks with uncertain health status. In 2022, Oceana Canada published an analysis using data-limited assessment methods revealing that stocks with an "uncertain" status can be categorized according to the Sustainable Fisheries Framework into 30 per cent (n=30) healthy, 32 per cent (n=32) cautious, 22 per cent (n=22) critical and 15 per cent (n=15) "uncertain" (Schijns, 2022).

3. **Change in status:** There was a notable change in the status of stocks from 2022 to 2023, with 12.9 per cent of index stocks (25 of 194 stocks) changing health categories (Table 1). Overall, there is no significant trend in the percentage of stocks changing health status from one year to the next ($p = 1.0$, $\chi^2 < 0.01$). As outlined above, two stocks moved from uncertain to certain and six stocks underwent the reverse. In addition, six stocks were identified as more at risk, declining from healthy levels to cautious or critical zones.[8] Eleven stocks were identified as less at risk, moving from critical/cautious to cautious/healthy zones.[9]

4. **Biomass/abundance known:** In 2023, 50.5 per cent of index stocks (98 of 194 stocks) had a biomass or abundance estimate made during a full, peer-reviewed assessment process within the last five years (i.e., CSAS national or regional peer-review processes or RFMO equivalents). This value is the lowest over the past seven years, and there was a significant trend in the proportion of stocks with recent assessments ($p = 0.01$, $\chi^2 = 6.0$) (Figure 5, Table 1). Meanwhile, several stocks assessed in 2015 (i.e., seven years ago) have not been reassessed since and are now considered outdated in this year's analysis.

   Of the 49.5 per cent of index stocks (96 stocks) without complete assessments in the last five years, 29.2 per cent (28 stocks) have had an interim update reporting on trends in proxies for biomass/abundance within the last five years (i.e., CSAS science response processes or RFMO equivalents; CSAS, 2021). This means that 64.9 per cent of index stocks have had at least some sort of evaluation of trends in abundance or biomass indices within the last five years to support fisheries management. However, of the interim updates, only one stock had indicators evaluated against predetermined thresholds used to trigger pre-defined management actions or a full assessment earlier than scheduled, suggesting the policy is not being consistently implemented (DFO, 2016b).

[8] Healthy to cautious: Acadian redfish in Unit 3, Dungeness Crab, Northern Shrimp in the Eastern Assessment Zone, Shrimp (Scotian Shelf) in SFA 13-15, Pacific Herring in the Strait of Georgia
Cautious to critical**:** Cusk in NAFO Divisions 4VWX5Z
[9] Critical to healthy: Northern (pink) shrimp in Fraser River SMA
Critical to cautious: Northern (pink) shrimp in SMA Georgia Strait East, Northern (pink) shrimp in SMA 16, Sidestripe shrimp in SMA Georgia Strait East, Sidestripe shrimp in SMA 16
Cautious to healthy: Sidestripe shrimp in Fraser River SMA, Canary rockfish, Sablefish, Snow crab in NAFO Divisions 3K; 3L (inshore); 3Ps

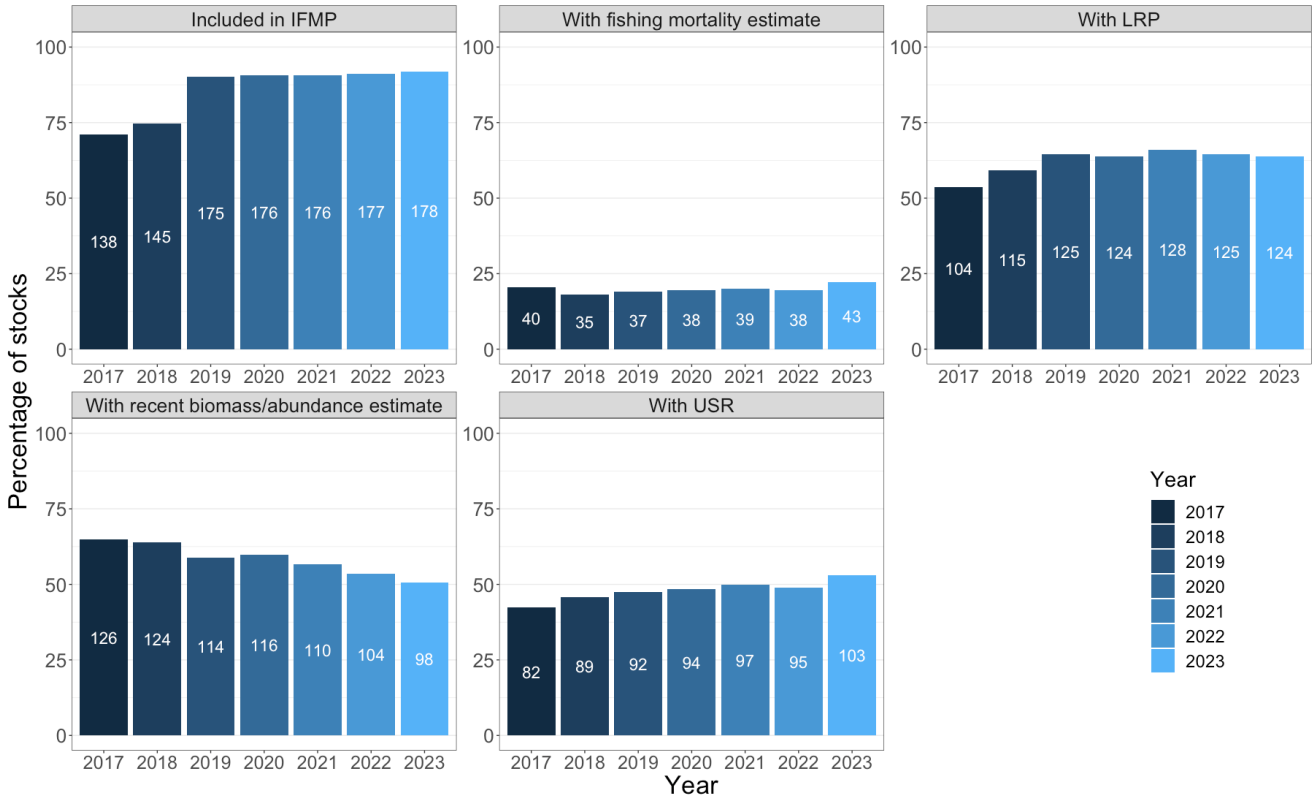

Figure 5. An assessment of how stocks perform on five indicators, based on Oceana Canada's index stock dataset (n = 194 stocks) from 2017 to 2023. The indicators included the percentage of stocks: 1) with a biomass/abundance estimate within the last five years; 2) with fishing mortality estimates; 3) with a limit reference point (LRP); 4) with an upper stock reference point (USR); and 5) included in an Integrated Fisheries Management Plan (IFMP). The number of stocks for each indicator is in black font within the bars. See the Introduction and Methods sections for further details on indicator definitions and calculations.

5. **Sources of mortality known:** In 2023, 22.2 per cent of index stocks (43 of 194 stocks) had sufficiently robust data or a modelling approach that allows for the estimation of fishing mortality, which is valuable in assessing whether overfishing is occurring (NMFS, 2019). This value is similar to past years, and there was no significant trend in the proportion of stocks with estimates of fishing mortality ($p = 0.80$, $\chi^2 = 0.07$). Ideally, fishing mortality estimates should include all sources of fishing mortality (DFO, 2009a; Gilman et al., 2013): commercially directed, recreational, bait, food-social-ceremonial, and bycatch. Only four stocks have recent stock assessment reports that clearly indicate all suspected sources were accounted for,[10] while 11 additional stock assessment reports clearly indicate they at least partially account for sources other than reported commercial landings (e.g., by reconstructing uncertain catch histories or by using censored-catch models that assume landings data is biased).[11]

[10] Pacific halibut, Winter skate in NAFO 4T, Atlantic cod in NAFO 3NO, Deepwater Redfish and Golden Redfish in NAFO Subarea 0.

[11] American plaice in NAFO 4T, bluefin tuna in the western Atlantic, Atlantic herring in NAFO 5YZ, Atlantic mackerel in NAFO subareas 3 and 4, Atlantic cod in NAFO 2J3KL (i.e., northern cod), Pacific cod in the Hecate Strait (5CD), Pacific cod in the

Several approaches have been developed to estimate natural mortality[12] within models and/or to allow it to vary (e.g., Turcotte et al., 2021). In 2023, 27.8 per cent of index stocks (54 of 194 stocks) have an estimate of natural mortality. Since the indicator was included in the 2018 Fishery Audit, there has been consistent improvement each year (Table 1) and a significant trend ($p = 0.002$, $\chi^2 = 9.94$), likely representing increased use of the new modelling approaches. In some mortality estimation approaches, only total mortality can be estimated. In 2023, 11.9 per cent of index stocks (23 of 194 stocks) have an estimate of total mortality. Since the indicator was first introduced in the 2018 Fishery Audit (Table 1) there has been a significant increasing trend ($p = 0.03$, $\chi^2 = 4.69$).

These notable improvements in the number of stocks with natural estimates hopefully signal improvements in the ability to estimate sources of mortality. Still, the number of stocks with fishing mortality estimates has remained relatively stable, and few of these stocks have all sources of fishing mortality incorporated in their estimation. These results indicate a lot more work is needed to ensure there is the data and ability to use the models required to estimate all sources of mortality. Having estimates of all sources of mortality would provide a better understanding of the environmental and fishing impacts on the population and surrounding ecosystem, enabling management decisions that are robust to uncertainties.

In the absence of the data and ability to estimate fishing mortality, it important to at least have an estimate of the exploitation rate. Exploitation rate indices are the proportion of the population removed by fishing (expressed as proportion of abundance or biomass) and provide an indication of fishing pressure. In 2023, the number of index stocks with exploitation rates or indices reported continues to be around half (50.0 per cent; 97 of 194 stocks), but since this indicator was first included in the 2019 Fishery Audit (Table 1) there has been a significant increasing trend ($p = 0.03$, $\chi2 = 4.67$).

If fishing mortality or exploitation rate estimates are not possible, it is important at a minimum to know the volume of fish landed in the commercial fishery. Oftentimes, reported landings exclude or underestimate catches from other targeted fisheries (i.e., recreational, Indigenous, bait) and non-directed activities (i.e., bycatch, discards) (Pauly, 1998). In 2023, most index stocks (97.9 per cent; 190 of 194 stocks) have estimates of reported landings included in their most recent stock assessment reports, essentially unchanged over the six years this indicator has been included (Table 1), with no significant trend ($p = 0.91$, $\chi2 = 0.01$).

6. **Reference points:**
   Upper Stock Reference (USR) and Limit Reference Point (LRP)

Queen Charlotte Sound (5AB), Pacific cod in West Coast Vancouver Island (WCVI), sablefish, yelloweye rockfish – inside population, yelloweye rockfish – outside population.

[12] Natural mortality (*M*) is a measure of mortality from causes other than fishing. It is calculated using empirical relationships between *M* and observable life-history characteristics. Age-structured population models (VPA and SCA) can be used to compare stationary and time-varying natural mortality parameters. In models that allow for non-stationarity in *M*, independent time series of *M* can be estimated for different age groups (e.g., Turcotte et al., 2021).

In 2023, 63.9 per cent of index stocks (124 of 194 stocks) have LRPs and 53.1 per cent (103 stocks) have USRs. The percentage of stocks with LRPs increased notably in earlier years, but the rate of improvement has slowed in recent years and decreased from 2021 to 2023 (Table 1). Overall, there was a significant increase in the percentage of stocks with LRPs since 2017 ($p = 0.005$, $\chi 2 = 7.80$). USR development has consistently increased from 2017 to 2023, with the exception of a slight decrease in 2022 (Table 1) but at a slower rate than LRPs. However, the trend in the percentage of stocks with USRs across years is not statistically significant trend ($p = 0.08$, $\chi 2 = 3.01$). Without reference points, it is difficult to apply the PA framework (DFO, 2009a), assess stock health, and identify targets for rebuilding depleted stocks to healthy levels. DFO has committed to developing reference points for all major commercial fish stocks (CESD, 2016), and the results here indicate it is making some progress. In the Pacific region, provisional LRPs and USRs were applied to most groundfish stocks (Anderson et al., 2021) and to all rockfishes (*Sebastes* spp.) assessed during 2011-2022 (DFO, 2022d, 2022e; Haggarty et al., 2022). But with about a third of the marine fish and invertebrate index stocks lacking LRPs and half lacking USRs, managers continue to operate without these benchmarks, and the status of many stocks remains uncertain. All index stocks in the critical and cautious zones have LRPs or their equivalent. However, around one fifth of these stocks are missing USRs (in the critical zone, 32.1 per cent or nine stocks are missing USRs; in the cautious zone, 8.6 per cent or three stocks are missing USRs). If stocks that are not doing well lack a USR, there is no target for rebuilding them to a healthy state.

Implementing reference points

Implementation of reference points has likely been hindered by vague and ambiguous policy language without accompanying operational guidelines for different species and data-richness scenarios, identified as important for successful policy implementation in other jurisdictions (Mace and Gabriel, 1999; Methot et al., 2014). In 2022, DFO held a workshop on "Science Advice on Guidance for Limit Reference Points under the Fish Stocks Provisions," to develop a set of best practices for estimating LRPs and stock status across the data spectrum (DFO, 2022c). The policy is clear that LRPs are to be established by fisheries scientists, and now there are guidelines on how science should develop them.

However, similar guidance is missing for USR and target reference points, making the role of scientists in establishing USRs and target reference points less clear (DFO, 2009a). Progress with LRPs has shown significant improvement over the last seven years, while USR development lags. Although DFO scientists have proposed USRs for several stocks, these have yet to be implemented by management (Archibald et al., 2021a; Archibald and Rangeley, 2021a).

An increasing body of research and commitments support implementing reference points that are compatible with Indigenous Knowledge Systems (IKS) and culturally meaningful levels to both act on legal obligations to the rights of Indigenous Peoples and restore biodiversity (Department of Justice Canada, 2023; Frid et al., 2023; Lam et al., 2023). Therefore, more reference points will need to be developed and revised to maintain populations at restored levels, along with additional guidelines for interpretation.

Reference points by taxonomic group

When reference point development is examined by taxa group, it is apparent that most taxa groups except rockfish, redfish, sharks and skates have had proportional increases in reference point presence over the past seven years (Figure 6a, 6b). However, the only changes over this past year are five new USR for forage fish (all Pacific herring stocks) and flatfish and invertebrates each lost an LRP. Invertebrates, which include stocks of Canada's most valuable seafood species (e.g., lobster, snow crab, shrimp and scallop) (DFO, 2016c), are still missing LRPs for 41.7 per cent of the taxonomic group, more than any other group except sharks and skates. Similarly, 48.8 per cent of invertebrate stocks are missing USRs. Many lobster, snow crab, and scallop stocks still lack the fundamental elements of the PA framework (Figures 6a and 7b), even though DFO has committed to develop reference points for many of these stocks (DFO, 2023a), and some PA frameworks have been proposed but not yet fully implemented by management (Archibald et al., 2021a; Archibald and Rangeley, 2021a).

Oftentimes, relatively immobile invertebrates are patchily distributed, which can make them more susceptible to serial depletion across areas, in addition to uncertainty regarding the degree of overlap between management and assessment units. Traditional reference points may not sufficiently capture the structure and scale of these stocks (Smith et al., 2012), and refining spatial reference points for fisheries may be more appropriate (e.g. to capture range contraction or area depletion). Methods for addressing scale mismatch and spatial reference points still need to be developed by DFO scientists, as noted as an area for future work in the National Peer Review meeting on "Science Advice on Guidance for Limit Reference Points under the Fish Stocks Provisions" (DFO, 2022c). Meanwhile, setting a LRP at the aggregate level and applying additional measures (e.g., spatial closures, rotational fisheries) at smaller spatial scales can serve as a good management strategy.

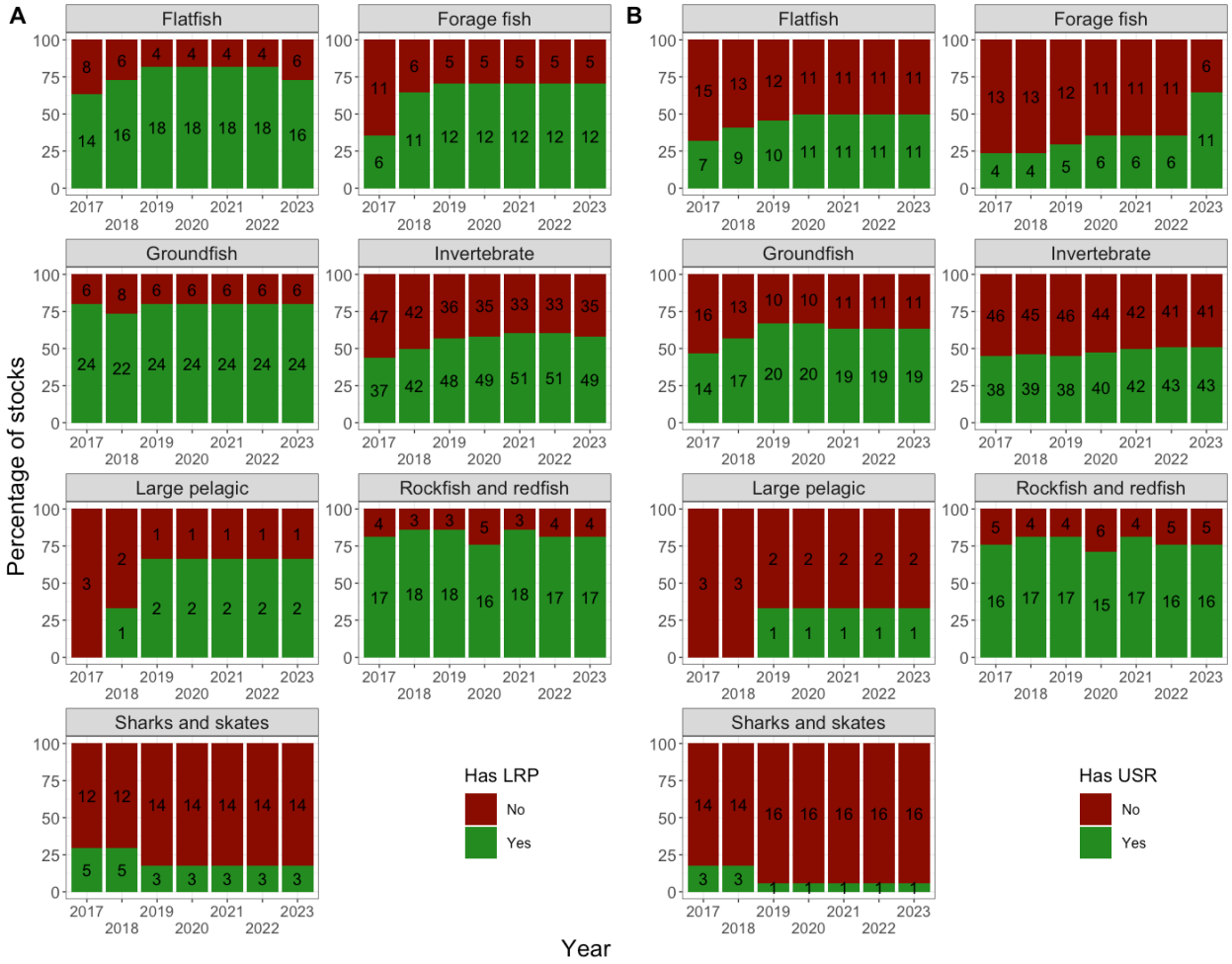

Figure 6. The percentage of Oceana Canada index stocks in each taxa groups with and without (A) Limit Reference Points (LRPs) and (B) Upper Stock References (USRs) in place from 2017 to 2023. The number of stocks in each year-taxa-category combination are reported in black font within the bars.

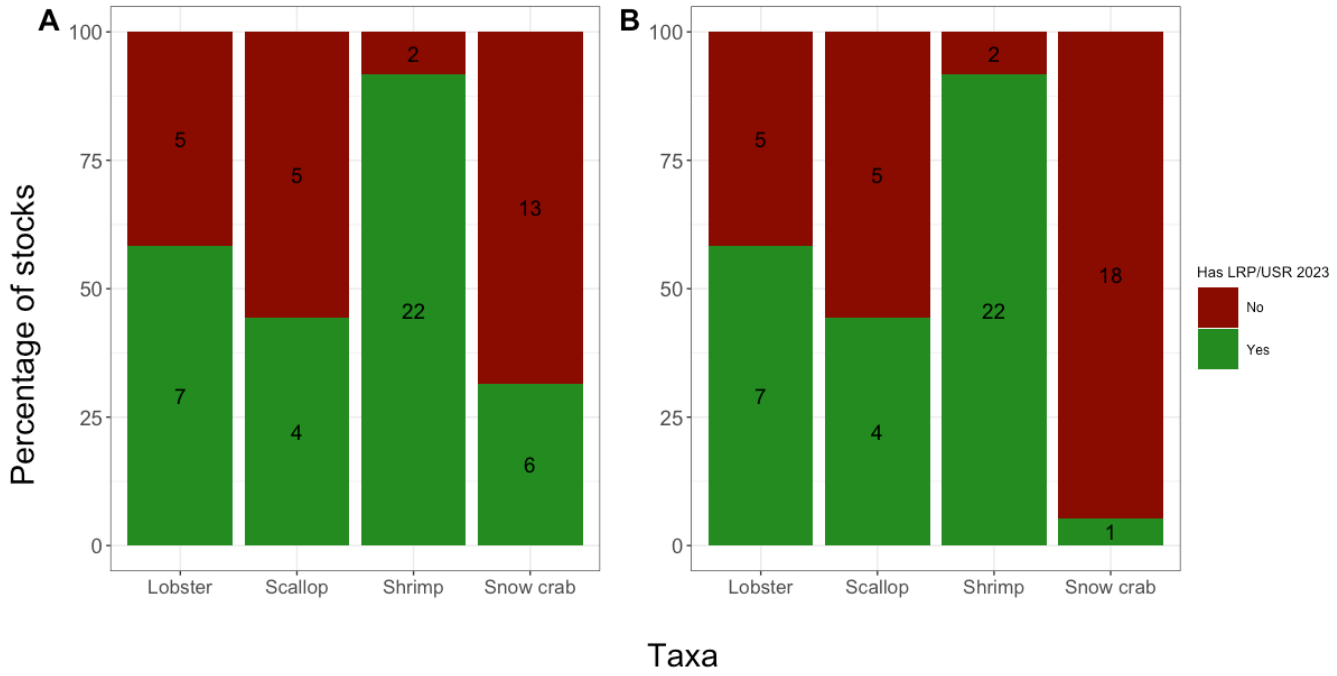

Figure 7. The percentage of Oceana Canada index stocks in high-value invertebrate groups (lobster, shrimp, snow crab, and scallops) with and without (A) Limit Reference Points (LRPs) and (B) Upper Stock References (USRs) in place in 2023. The number of stocks in each taxa-category combination are reported in black font within the bars.

Removal Reference

In addition to biomass or abundance-based reference points, the DFO PA framework also requires a removal reference for each stock status zone: the maximum acceptable removal rate for the stock, which is normally expressed in terms of fishing mortality (F) or harvest rate (DFO, 2009a). According to DFO policy, removal references are supposed to include all sources of fishing mortality from all types of fishing and must be less than or equal to the removal rate associated with maximum sustainable yield (e.g., F_{MSY}) (DFO, 2009a). However, in practice, removal references implemented appear to be serving the role of limit and target, which can increase the chances of exceeding them and means they may not always represent unacceptable stock states associated with "overfishing" as it is recognized internationally (DFO, 2021a). The ability to use them to report on "overfishing" status is further complicated when they are only partially defined (i.e., only available for one stock status zone) (DFO, 2021a). Both situations appear to be common. When the answers defining the removal reference values are examined in the most recent (2021) results of the DFO SSF (DFO, 2023b), the inconsistent interpretation of policy requirements becomes clear. Some DFO science and resource manager respondents cite target and limit functions with values based on F_{MSY}; some outline how harvest control rules work (which may or may not involve stock status zones, a separate question in the SSF); and some indicate that recent quota decisions by management serve as the removal reference. Meanwhile, few stocks even have them in place, with the latest results (2021) of the DFO SSF indicating around a third of the "major" stocks have a removal reference for the healthy zone (35.9 per cent or 69 of 192 stocks), less than half have a removal reference for the cautious zone (44.4 per cent) and even fewer have one for the critical zone (22.7 per cent) (DFO, 2023b).

This low implementation rate and inconsistent application of policy regarding removal references (DFO, 2021a) — combined with the ambiguity of scientists' role in defining them (Winter and Hutchings, 2020) and Oceana Canada's findings here that few existing fishing mortality estimates include all sources of fishing removals — have led to the exclusion of removal references as an indicator in this report. DFO scientists recently noted several of these issues with the current application of removal references (DFO, 2021a). They advised that the science sector could be responsible for characterizing stock status relative to a single-limit fishing mortality rate, such as F_{MSY} or suitable proxies, which would make Canada's approach consistent with international requirements (i.e., United Nations Fish Stocks Agreement) and definitions of the term "overfishing" (DFO, 2021a; FAO, 2020; Froese and Proelss, 2012). Furthermore, when reporting fishing mortality status relative to the removal reference, the probability, or qualitative likelihood, that fishing mortality is greater than the removal reference should be included (DFO, 2021c). This change, if implemented, would allow Canadians increased confidence in the biological sustainability of harvest rates and a more nuanced and meaningful evaluation of stock status. If stock status was evaluated using both science-based biomass/abundance numbers and science-based fishing mortality reference points, it would be possible to identify depleted stocks still subject to overfishing and focus management rebuilding efforts where they are needed most.

7. **Management plans in place:** In 2023, 91.8 per cent of index stocks (178 of 194 stocks) were included in an IFMP. The culmination of slight changes in this indicator over recent years (2020–2023) and continual increases in earlier years (Figure 5, Table 1), results in a significant increasing trend in the number of stocks included in IFMPs since 2017 ($p < 0.001$, $\chi 2 = 45.9$). This trend is likely driven largely by the notable increase in 2019 that was due to the publication of several new multi-stock IFMPs. However, there are numerous IFMPs that include multiple species with different life histories and sensitivities that have not been assessed. Since 2019, progress on IFMP development has been minimal, as most index stocks are already included in IFMPs.

   In 2023, all but two[13] of the index stocks with IFMPs are also available online. Each stock should be included in an IFMP, and entire IFMPs (not just summaries) should be publicly available. If fish stocks are not included in a management plan, fisheries managers lack the framework required for conservation and sustainable use, and if those plans are not easily accessible, it is difficult for stakeholders and the public to assess how a fishery is being managed. DFO has committed to having all major commercial fish stocks included in IFMPs and making these available to the public on its website (CESD, 2016), which has resulted in the large increases in this indicator. There is still some more work to do, so it is expected that this indicator will continue to rise, if only slightly (see Archibald et al., 2021c). However, it should be noted that the IFMP-related deliverables for several stock groups in DFO's Sustainable Fisheries Framework Work Plan pertain to updating out-of-date IFMPs, which would not be reflected by this indicator as they are already included in IFMPs.

8. **Catch monitoring:**

[13] Atlantic herring in NAFO area 4T (spring and fall spawning components) do not have a publicly available IFMP. The Departmental work plan indicates that the IFMP will be completed and posted online in 2023-2024 (DFO, 2023a).

At-sea observer or electronic monitoring

In 2023, 85.6 per cent of index stocks (166 of 194 stocks) have fisheries with some level of at-sea observer or electronic (i.e., video) monitoring required (Figure 8, Table 1). Of these 166 stocks, 42 have fisheries with 100 per cent monitoring, while 124 have fisheries with varying target monitoring levels depending on the vessel size or gear type. The presence of at-sea or electronic monitoring was uncertain in 14.4 per cent of stocks (28 stocks). This indicator has changed over the past seven years, with a significant increasing trend in the percentage of stocks with fisheries with some level of at-sea observer or electronic (i.e., video) monitoring (Figure 8) ($p < 0.001$, $\chi2 = 26.9$). However, this increase is likely due to increased transparency rather than changing requirements for harvesters. Increased transparency from the increase in the number of stocks in IFMPs and the availability of those IFMPs has resulted in increased clarity on fishery monitoring requirements. Furthermore, in 2019, DFO published a review of catch monitoring tools in major Canadian fisheries that provided further documentation on targeted at-sea observer coverage levels (Beauchamp et al., 2019).

Logbooks

In 2023, most index stocks require the use of logbooks (96.4 per cent; 187 of 194 stocks) (Figure 8, Table 1). However, the requirement to record the entire catch (targeted species and bycatch) is clearly indicated for only 39.2 per cent of index stocks (76 of 194 stocks); 57.2 per cent (111 stocks) have fisheries where logbooks are used, but it was not clear from the materials searched whether the entire catch must be recorded. There is uncertainty about the use of logbooks for 3.6 per cent of stocks (8 stocks). This indicator has changed over the years, with a significant increasing trend in the percentage of stocks with fisheries that use logbooks (Figure 8) ($p < 0.001$, $\chi2 = 47.1$). Again, however, this increase is likely due to increased transparency rather than changing requirements for harvesters, for the same reasons noted above. This increase in transparency has resulted in more certainty about general logbook use and details recorded since 2017.

Dockside monitoring

In 2023, 88.1 per cent of index stocks (171 of 194 stocks) have fisheries that require some level of dockside monitoring of landings (Figure 8, Table 1). Of these 171 stocks requiring dockside monitoring, 124 stocks have fisheries that are required to have 100 per cent of landings verified by a certified independent dockside monitor. A further 47 stocks have dockside monitoring requirements, but the level of monitoring is varied or unknown. The use of dockside monitoring in the fisheries of 11.9 per cent of stocks (23 stocks) is uncertain. This indicator has changed over the past seven years, with a significant increasing trend in the percentage of stocks that have fisheries that require some level of dockside monitoring of landings (Figure 8) ($p < 0.001$, $\chi2 = 26.4$). Again, however, this increase is likely due to increased transparency rather than changing requirements for harvesters, for the same reasons noted above. This increase in transparency has resulted in more certainty in the general use of dockside monitoring, to whom it applies, and the levels targeted since 2017.

Vessel monitoring system

In 2023, 69.6 per cent of index stocks (135 of 194 stocks) have fisheries with at least some vessels requiring electronic location monitoring (Figure 8, Table 1). Less than one-quarter (18.6

per cent or 36 of 194 stocks) do not require any vessels to be electronically monitored,[14] while the use of this tool is uncertain for 11.9 per cent of index stocks (23 of 194 stocks). Of the 135 stocks with some use of VMS, 59 stocks have fisheries where 100 per cent of vessels always require electronic location monitoring; 50 stocks have fisheries that use the tool for some, but not all vessels; and 26 stocks have fisheries that use the tool, but it is uncertain if it is used by all vessels or at all times. There was no significant trend in the percentage of stocks that have fisheries with at least some vessels requiring VMS ($p = 0.60$, $\chi 2 = 0.28$).

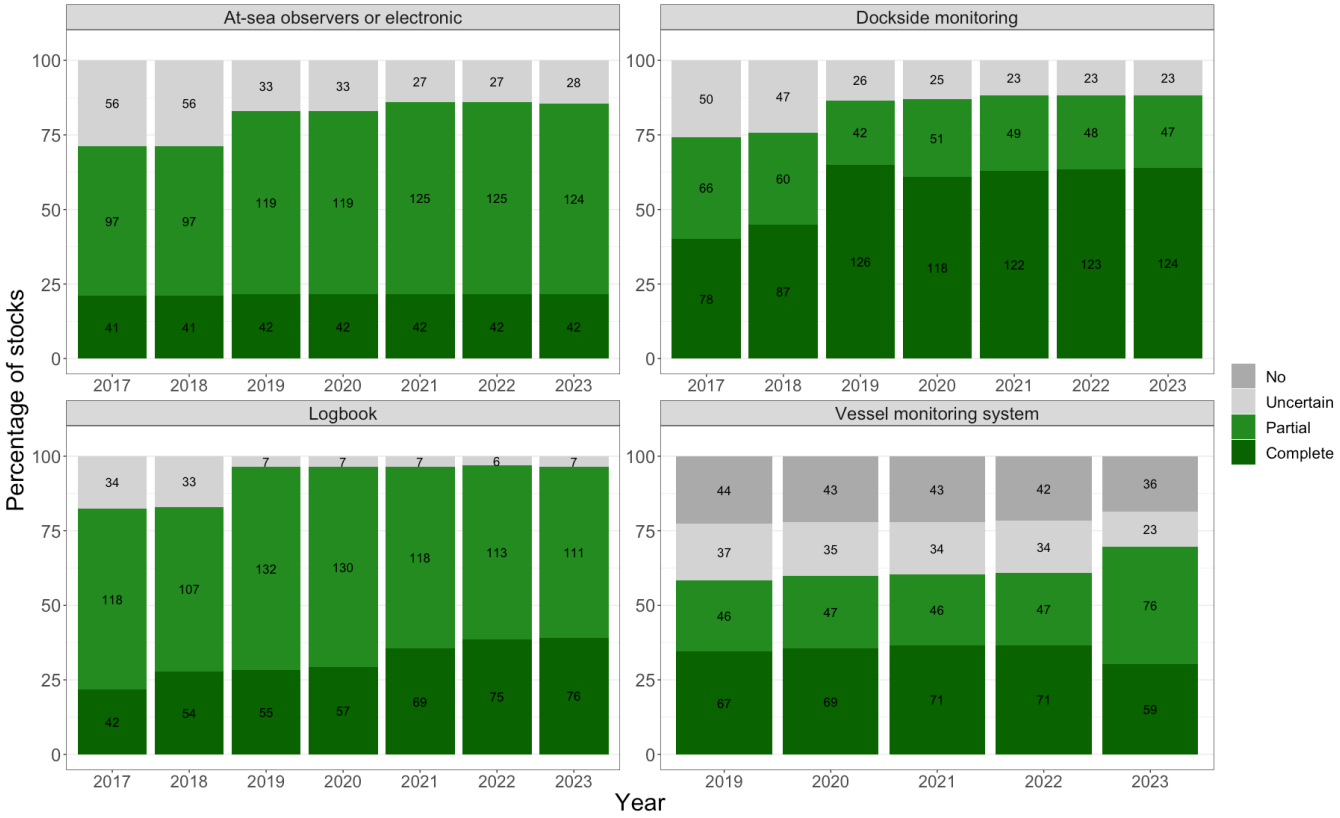

Figure 8. The percentage of stocks in Oceana Canada's index stock dataset from 2017 to 2023 that have requirements for the following catch monitoring tools in place: 1) at-sea observer or electronic (i.e., video) monitoring; 2) logbooks recording the entire catch (i.e., targeted species and bycatch); 3) independent dockside monitoring; 4) electronic location monitoring via Vessel Monitoring System (VMS). Note that VMS usage was not evaluated in 2017–18. The number of stocks with each level of targeted monitoring tool use is indicated in black font within the bars. "Uncertain" level was assigned when there was no indication in the documents and websites searched that the use of the monitoring tool is required. "Partial" level was assigned when it was clearly indicated the monitoring tool was required but targeted levels of tool use vary or are uncertain or, for logbooks, when it was unclear if bycatch is recorded. "Complete" level was assigned when it was clearly indicated the monitoring tool is required on 100 per cent of fishing trips or, for logbooks, when both directed catch and bycatch are recorded. It should be noted, 100 per cent coverage for at-sea observers or electronic monitoring (i.e., video monitoring) or VMS is not necessary for all fisheries.

These results are based on publicly available information from scattered sources with varying levels of detail and, as such, likely do not reflect the full extent of catch monitoring in Canada.

[14] It should be noted that not all stocks are harvested using vessels; for example, some clam fisheries are shore-based.

This is reflected in the high number of stocks in the partial-use categories. Often, more than one fishery catches a given stock, making assessments of catch monitoring on that stock challenging (i.e., due to different levels of at-sea observer coverage, varying by gear type and/or vessel size). DFO scientists reviewed catch monitoring tools used in major Canadian fisheries, which contributed to the large increase in clarity on tool use and targeted levels for most stocks and fishery sub-units since 2019 (Beauchamp et al., 2019). However, targeted coverage levels are often not achieved, and even when they are, levels can be inadequate to assess impacts to non-target species and sensitive habitats (Benoît and Allard, 2009; CESD, 2016; Clark et al., 2015; Gavaris et al., 2010). Furthermore, the CESD audit found that DFO did not provide a clear rationale for determining targeted levels of at-sea coverage and lacked systematic controls to ensure targets are met (CESD, 2016).

DFO reviewed the catch monitoring programs of fisheries in Canada, acknowledging the current shortcomings, and in November 2019 finalized and released a national Fishery Monitoring Policy (DFO, 2019c) (originally intended to be released in 2017; CESD, 2016). As indicated by the department's own consultation on a draft national fishery monitoring policy (DFO, 2018a), not having a national policy on catch reporting and fishery monitoring until now has led to:

- Inconsistent monitoring and reporting requirements with no rationale for the differences;
- Concerns about the adequacy and quality of data from fishery monitoring programs; and
- An absence of national goals with which to assess performance.

Furthermore, a lack of a national policy precluded the consideration of cumulative impacts across fisheries on species or the ecosystem (Archibald and Rangeley, 2019a).

The new policy includes guidance on assessing risk of fisheries to target stock health and species caught as bycatch; the risk of non-compliance with the rules; and data quality and dependability (Allard and Benoît, 2019; Benoît and Allard, 2020; DFO, 2019c, 2019d). Together, these tools can be used to determine the dependability of a fishery monitoring program and inform a gap analysis for improvements that may be required to tailor monitoring requirements to the risk levels that respective fisheries pose to fish populations and the ecosystem. One requirement of the policy is for specific and measurable fishery monitoring objectives to be included in IFMPs, along with the monitoring necessary to achieve them. This would be an improvement over the current situation, in which only one stock in the index dataset has specific and measurable fishery monitoring objectives in their IFMP (see methods section). It is expected this new indicator will increase in future years as the policy is implemented and DFO determines and ensures the appropriate type and frequency of catch monitoring in all our fisheries.

This policy was developed by DFO to improve data quality used in Canada's fisheries science and management. The policy can also improve transparency and public confidence in management, while contributing to more stability and better market access for the fishing industry (Archibald et al., 2021c). Despite being released five years ago, it has yet to be fully implemented in any fishery. However, there are encouraging signs of progress over the past three years, as the policy is now included in the Sustainable Fisheries Framework work plan, which outlines priorities for DFO (DFO, 2021b). Up until this year, the work plan only included a few stocks for Fishery Monitoring Policy related activities and many activities were not completed. In the 2023/24 Sustainable Fisheries Framework work plan, 25 monitoring activities are expected to be

completed by the end of the 2023/2024 fiscal year (DFO, 2023a). If the policy is effectively implemented, Canada will have better science and data-driven fisheries management. It will take time to gather enough of the data required to make good use of it. Continued delays in implementation will therefore delay the benefits of this policy and make other DFO commitments harder to achieve, including the rebuilding mandate outlined in the amended *Fisheries Act*. These amendments provide an opportunity to restore the abundance of Canada's wild fisheries. Our ability to realize this potential depends on DFO accurately measuring and managing these fisheries by implementing the Fishery Monitoring Policy.

9. **Critical stocks with rebuilding plans:** In 2023, rebuilding plans are in place for 21.4 per cent of index stocks in the critical zone (six of 28 stocks) and for 6.2 per cent of all index stocks (12 of 194 stocks). There has been little change in this indicator over time (Figure 9, Table 1), with no significant trend in the percentage of critical stocks included in rebuilding plans across years ($p = 0.15$, $\chi 2 = 2.07$). This is despite a policy requirement for well over a decade for rebuilding plans to be in place for critically depleted stocks (DFO, 2009a), recent commitments and work plans to develop them (CESD, 2016; DFO, 2020d), and revisions to the *Fisheries Act* to require them (Legislative Services Branch, 2019). The recently amended legislation is expected to cause this indicator to rise significantly, as the first batch of stocks prescribed under the Fish Stocks provisions came into effect on April 2022, triggering rebuilding plans to be developed within 24 months for critically-listed stocks.

   The initial set of prescribed stocks included 16 stocks deemed to be below their LRPs. However, the current set comprises 13 stocks, including two Pacific salmon management units. In the Pacific region, three stocks, specifically Bocaccio rockfish, yelloweye (inside) rockfish, and Interior Fraser Coho Salmon, are now considered to be above their respective LRPs based on recent assessments. Bocaccio rockfish growth is attributed to a large recruitment event while yelloweye's change in stock status is due to an updated model structure. Given how rapidly stocks can move out of the critical zone, they should continue to be managed with caution to ensure that their growth was not simply a short-term fluctuation and that the populations maintain full health for the long-term future.

   Three critical stocks in the first batch (Atlantic cod in 2J3KL, Atlantic mackerel, northern shrimp in SFA 6) have existing rebuilding plans (DFO, 2018d; 2020b; 2020c). However, the plans are insufficient in that they don't reflect DFO's own policy guidance (DFO, 2013; replaced by DFO, 2022a) to include elements such as scientifically informed rebuilding timelines (Levesque et al., 2021; Hutchings et al., 2021). They also they don't meet international standards (which require limit *and target* reference points)[15] since they lack target refence points to grow the population to the healthy zone (FAO, 2020). The existing plans will need to be revised to comply with the rebuilding regulations. Therefore, by April 2024 a net increase of 11 new rebuilding plans is expected.

   According to the 2021/22 DFO Sustainable Fisheries Framework Work Plan, eight rebuilding plans were expected to be completed by the end of March 2022 (DFO, 2021b). None have been

[15] United Nations Convention on the Law of the Sea

published on time, and with the latest work plan, all deadlines were extended following listing under the Fish Stocks provisions to 2023/2024 (DFO, 2023a). While the COVID-19 pandemic certainly impacted progress in the past three years, it has now been seven years since the initial work plan was created (CESD, 2016; DFO, 2017b). Rebuilding plan development is a significant workload commitment, and to meet international best practices, these plans must be developed in close consultation with the rights-holders and stakeholders (DFO, 2013; Garcia, 2018; OECD, 2012), which takes time. Delays prior to the pandemic, along with the lengthy process of reviewing and finalizing new rebuilding plan regulations, likely contributed to DFO being unable to fulfill its previous commitments (Archibald et al., 2021a).

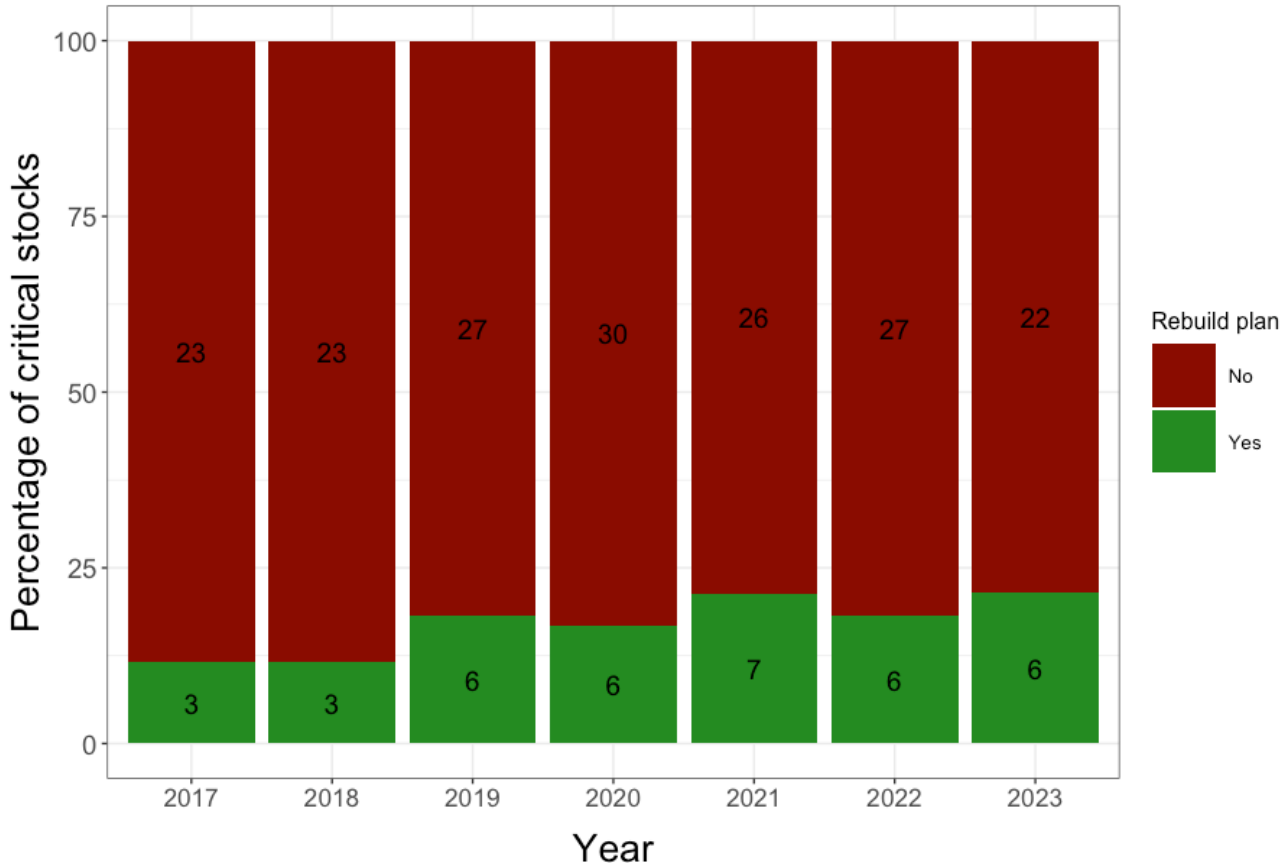

Figure 9. The percentage of Oceana Canada index stocks (n = 194 stocks) in the critical zone and included in rebuilding plans from 2017 to 2023. The number of stocks in each year-category combination is reported in black font within the bars.

This year, no new rebuilding plans were published. However, important developments have occurred that will result in published materials soon. Two draft rebuilding plans for Haida Gwaii Pacific herring and Atlantic herring in NAFO Division 4T (spring spawner component) finished their consultation periods, while a multispecies plan for Gulf groundfish, 3Ps Atlantic cod and Atlantic mackerel plans are in development. For details on how the new rebuilding plan materials compare with the requirements under the new Fish Stocks provisions in the amended *Fisheries Act* and additional elements, see Schijns and Rangeley (2023a).

It is expected that all federally managed critical stocks will be prescribed in future batches[16]. Since many critical stocks have been in decline for decades, the timely development and implementation of rebuilding plans must be reinforced by maintaining a conservative approach to fisheries management throughout the planning process. Rebuilding plans developed collaboratively can address socioeconomic, cultural, and ecological impacts and set goals for achieving both regulatory requirements as well as planning for future fishing opportunities in restored conditions.

10. **Climate change considerations:** In 2022, only 16.5 per cent (32 of 194 stocks) of Oceana Canada's marine fish and invertebrate index stocks fully incorporate climate change effects within the latest departmental science and management documents in a dedicated written section or integrated in models (Figure 10). Another 20.1 per cent (39 of 194 stocks) mention the effects of climate change in some capacity. However, 63.4 per cent (123 of 194 stocks) do not mention or include climate considerations in science and management documents, despite peer-reviewed evidence that indicates the species in the same or neighbouring area is experiencing climate-induced effects for the majority of these stocks (90.2 per cent or 111 of 123 stocks). Three stocks were automatically marked with absent information, due to a lack of available management documents. There is peer-reviewed literature that describes climate effects on stocks in similar or neighbouring regions for 90.7 per cent (176 of 194 stocks) of the stocks in this dataset. Overall, there was an 8 per cent increase from 2022 to 2023 (56 of 194 stocks in 2022 to 71 of 194 stocks in 2023) that incorporate or mention climate change effects in science and management documents.

    More assessments and management plans incorporate or mention climate change effects for stocks that are healthy (30 of 55 stocks) than for stocks with critical, cautious or uncertain status. Even though 85.7 percent (24 of 28 stocks) are moderate to highly vulnerable to climate change effects, the vast majority (19 or 28 stocks) of critical stocks do not take climate change into account in relevant science and management documents.

[16] The Department of Fisheries and Oceans states that not all critical zone stocks are suitable candidates for prescription to the FSP – for example, RFMO managed stocks like Northern Shrimp in SFA 7 will not be prescribed to the FSP, despite being in the Critical zone as the management measures for the stock are set by the RFMO – in this case NAFO - rather than by Canada.

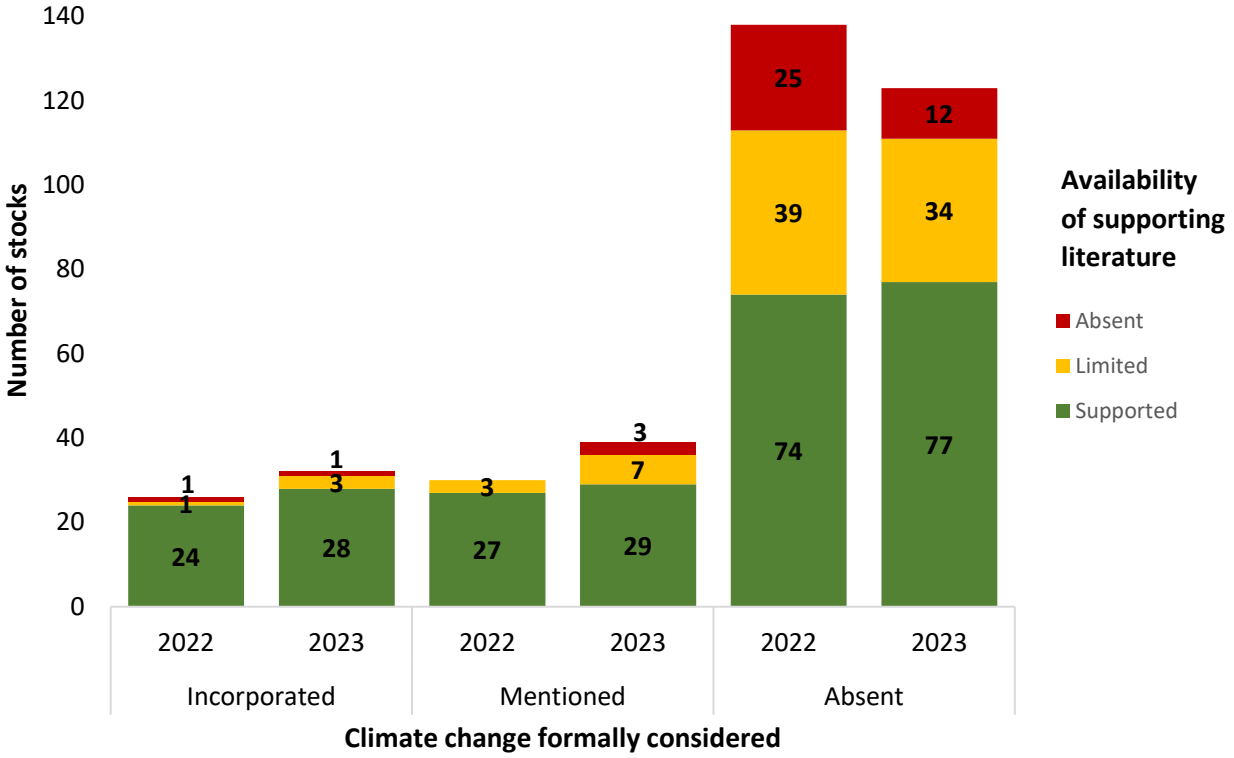

Figure 10. The number of Oceana Canada index stocks (n = 194 stocks) with climate change formally considered in fisheries science and management documents and the availability of supporting literature within each bar from 2022 to 2023.

Recommendations

In the year ahead, Oceana Canada calls on DFO to leverage the knowledge and policy tools already available to deliver on commitments and implement real change on the water. This means:

1. **Prescribe all remaining stocks in the critical and cautious zones** under the Fish Stocks provisions in the *Fisheries Act* and make management decisions that are consistent with the rebuilding regulations.
2. **Manage fisheries based on the best available science and Indigenous Knowledge Systems** by revising the suite of policies under the Sustainable Fisheries Framework to meaningfully implement Two-Eyed Seeing approaches, including through collaborative agreements.
3. **Account for climate change effects on marine ecosystems** by implementing climate-adaptive approaches in fisheries management and prioritizing the rebuilding of depleted forage fish.
4. **Count everything caught in a fishery** — including for recreational and bait purposes — and make decisions that account for all sources of fishing mortality.

To address these high-level priorities, Oceana Canada calls on DFO to accelerate progress on these key actions within the next year. This includes fulfilling ongoing commitments or those that have been delayed from previous work plans.

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Tables

Table 1. The percentage and number of marine fish and invertebrate[17] stocks for each indicator in the 2017 to 2023 index stock datasets (n = 194 stocks; the same stocks in each year).

Indicator	Details	2017	2018	2019	2020	2021	2022	2023
	Number of stocks	194	194	194	194	194	194	194
1. Status	%/# of "healthy" stocks	34.5% / 67	34.0% / 66	29.4% / 57	26.3% / 51	30.4% / 59	30.4% / 59	28.4% / 55
	%/# of "cautious" stocks	16.0% / 31	15.5% / 30	15.5% / 30	18.0% / 35	16.0% / 31	15.5% / 30	18.0% / 35
	%/# of "critical" stocks	13.4% / 26	13.4% / 26	17.0% / 33	18.6% / 36	17.0% / 33	17.0% / 33	14.4% / 28
	%/# of "uncertain" stocks	36.1% / 70	37.1% / 72	38.1% / 74	37.1% / 72	36.6% / 71	37.1% / 72	39.2% / 76
2. Stocks going from uncertain to certain status (or vice versa) in the past year	# of stocks that went from uncertain status to known status	Baseline year	4	6	6	5	0	2
	# of stocks that went from known status to uncertain status	Baseline year	6	8	4	4	1	6
3. Change in status from previous year	%/# of stocks that have changed status	Baseline year	10.8% / 21†	13.4% / 26†	13.4% / 26†	10.8% / 21†	1.5% / 3†	12.9% / 25†
	# of stocks whose status improved	Baseline year	5	2	5	9	1	11
	# of stocks whose status worsened	Baseline year	6	10	11	3	1	6
	%/# of stocks whose status remained the same	Baseline year	89.2% / 173	86.6% / 168	86.6% / 168	89.2% / 173	98.5% / 191	87.1% / 169
4. Biomass/abundance known	%/# of stocks with recent (≤ 5 years) biomass/abundance estimates	64.9% / 126	63.9% / 124	58.8% / 114	59.8% / 116	56.7% / 110	53.6% / 104	50.5% / 98

[17] Excluding marine mammals, diadromous fish, and freshwater fish

Indicator	Details	2017	2018	2019	2020	2021	2022	2023
	%/# of stocks without recent assessments (n=96 in 2023) that have had interim updates of indicators since their last complete assessment	Not available — new indicator	Not available — new indicator	20.0% / 16	23.1% / 18	23.8% / 20	24.4% / 22	29.2% / 28
5. Sources of mortality known*	%/# of stocks with fishing mortality (F) known	20.6% / 40	18.0% / 35	19.1% / 37	19.6% / 38	20.1% / 39	19.1% / 38	22.2% / 43
	# of stocks that clearly incorporate all sources of F in their estimation	Not available — new indicator	Not available — new indicator	2	2	2	3	3
	%/# of stocks with natural mortality (M) known	Not available — new indicator	14.4% / 28	16.0% / 31	19.6% / 38	21.6% / 42	25.3% / 49	27.8% / 54
	%/# of stocks with total mortality (Z) known	Not available — new indicator	6.7% / 13	8.8% / 17	11.3% / 22	12.4% / 24	12.4% / 24	11.9% / 23
	%/# of stocks with exploitation rate known	Not available — new indicator	Not available — new indicator	38.7% / 75	45.4% / 88	49.0% / 95	49.0% / 95	50.0% / 97
	%/# of stocks with landings known	Not available — new indicator	Not available — new indicator	97.9% / 190	97.4% / 189	97.9% / 190	97.9% / 190	97.9% / 190
6. Reference points	%/# of stocks with limit reference points	53.6% / 104	59.3% / 115	64.4% / 125	63.9% / 124	66.0% / 128	64.4% / 125	63.9% / 124

Indicator	Details	2017	2018	2019	2020	2021	2022	2023
	%/# of stocks with upper stock reference points	42.3% / 82	45.9% / 89	47.4% / 92	48.5% / 94	50.0% / 97	49.0% / 95	53.1% / 103
7. Management plans in place	%/# of stocks in an Integrated Fisheries Management Plan	71.1% / 138	74.7% / 145	90.2% / 175	90.7% / 176	90.7% / 176	90.7% / 176	91.8% / 178
8. Catch monitoring	%/# of stocks with at-sea/electronic monitoring	Yes — 100% 21.1% / 41	Yes — 100% 21.1% / 41	Yes — 100% 21.6% / 42	Yes — 100% 21.6% / 42	Yes — 100% 21.6% / 42	Yes — 100% 21.6% / 42	Yes — 100% 21.6% / 42
		Yes — coverage varies or level is uncertain 50.0% / 97	Yes — coverage varies or level is uncertain 50.0% / 97	Yes — coverage varies or level is uncertain 61.3% / 119	Yes — coverage varies or level is uncertain 61.3% / 119	Yes — coverage varies or level is uncertain 64.4% / 125	Yes — coverage varies or level is uncertain 64.4% / 125	Yes — coverage varies or level is uncertain 63.9% / 124
		Uncertain 28.9% / 56	Uncertain 28.9% / 56	Uncertain 17.0% / 33	Uncertain 17.0% / 33	Uncertain 13.9% / 27	Uncertain 13.9% / 27	Uncertain 14.4% / 28
	%/# of stocks with logbooks	Yes — and bycatch species are recorded 21.6% / 42	Yes — and bycatch species are recorded 27.8% / 54	Yes — and bycatch species are recorded 28.4% / 55	Yes — and bycatch species are recorded 29.4% / 57	Yes — and bycatch species are recorded 35.6% / 69	Yes — and bycatch species are recorded 38.7% / 75	Yes — and bycatch species are recorded 39.2% / 76
		Yes — but unclear if bycatch species are recorded 60.8% / 118	Yes — but unclear if bycatch species are recorded 55.2% / 107	Yes — but unclear if bycatch species are recorded 68.0% / 132	Yes — but unclear if bycatch species are recorded 67.0% / 130	Yes — but unclear if bycatch species are recorded 60.8% / 118	Yes — but unclear if bycatch species are recorded 58.2% / 113	Yes — but unclear if bycatch species are recorded 57.2% / 111
		Uncertain 17.5% / 34	Uncertain 17.0% / 33	Uncertain 3.6% / 7	Uncertain 3.6% / 7	Uncertain 3.6% / 7	Uncertain 3.1% / 6	Uncertain 3.6% / 7

Indicator	Details	2017	2018	2019	2020	2021	2022	2023
	%/# of stocks with dockside monitoring	Yes — 100% 40.2% / 78	Yes — 100% 44.8% / 87	Yes — 100% 65.5% / 127	Yes — 100% 61.3% / 119	Yes — 100% 63.4% / 123	Yes — 100% 64.4% / 125	Yes — 100% 63.9% / 124
		Yes — coverage varies or level is uncertain 34.0% / 66	Yes — coverage varies or level is uncertain 30.9% / 60	Yes — coverage varies or level is uncertain 21.6% / 42	Yes — coverage varies or level is uncertain 26.3% / 51	Yes — coverage varies or level is uncertain 25.3% / 49	Yes — coverage varies or level is uncertain 24.7% / 48	Yes — coverage varies or level is uncertain 24.2% / 47
		Uncertain 25.8% / 50	Uncertain 24.2% / 47	Uncertain 12.9% / 25	Uncertain 12.4% / 24	Uncertain 11.3% / 22	Uncertain 10.8% / 21	Uncertain 11.9% / 23
	%/# of stocks with electronic vessel monitoring systems (VMS)/automated identification systems (AIS)	Not available — new indicator	Not available — new indicator	Yes — 100% of vessels always 34.5% / 67	Yes — 100% of vessels always 35.6% / 69	Yes — 100% of vessels always 36.6% / 71	Yes — 100% of vessels always 36.1% / 71	Yes — 100% of vessels always 30.4% / 59
		Not available — new indicator	Not available — new indicator	Yes — some vessels but not all vessels 16.0% / 31	Yes — some vessels but not all vessels 19.6% / 38	Yes — some vessels but not all vessels 19.1% / 37	Yes — some vessels but not all vessels 19.6% / 38	Yes — some vessels but not all vessels 26.3% / 51
		Not available — new indicator	Not available — new indicator	Yes — but uncertain if all vessels or all times 7.7% / 15	Yes — but uncertain if all vessels or all times 4.6% / 9	Yes — but uncertain if all vessels or all times 4.6% / 9	Yes — but uncertain if all vessels or all times 4.6% / 9	Yes — but uncertain if all vessels or all times 12.9% / 25
		Not available — new indicator	Not available — new indicator	Uncertain 19.1% / 37	Uncertain 18.0% / 35	Uncertain 17.5% / 34	Uncertain 17.5% / 34	Uncertain 11.9% / 23

Indicator	Details	2017	2018	2019	2020	2021	2022	2023
		Not available — new indicator	Not available — new indicator	No 22.7% / 44	No 22.2% / 43	No 22.2% / 43	No 21.6% / 42	No 18.6% / 36
	%/# of stocks with specific catch monitoring objectives in their IFMP	Not available — new indicator	Not available — new indicator	0.0% / 0	0.0% / 0	0.0% / 0	0.0% / 0	0.5% / 1
9. Critical stocks with rebuilding plans	%/# of critical zone stocks (n=28 in 2023) with rebuilding plans	11.5% / 3	11.5% / 3	18.2% / 6	16.7% / 6	21.2% / 7	18.2% / 6	21.4% / 6

† *This value includes those that changed status to or from uncertain.*
* *Sometimes it is not possible to estimate mortality with available data or models.*

Table 2. The percentage and number of marine fish and invertebrate stocks[18] for each indicator in 2017 (n = 194 stocks), 2018 (n = 214 stocks), 2019 (n = 222 stocks), 2020 (n = 226 stocks), 2021 (n = 229 stocks), 2022 (n=230), 2023 (n=230) using all stocks in the dataset, including those added during the updates in addition to the index stock dataset (i.e., 2017 dataset stock list).

Indicator	Details	2017	2018	2019	2020	2021	2022	2023
	Number of stocks	194	214	222	226	229	230	230
1. Status	%/# of "healthy" stocks	34.5% / 67	31.8% / 68	27.5% / 61	24.8% / 56	27.9% / 64	27.8% / 64	26.1% / 60
	%/# of "cautious" stocks	16.0% / 31	14.5% / 31	14.4% / 32	16.4% / 37	15.3% / 35	14.8% / 34	17.0% / 39
	%/# of "critical" stocks	13.4% / 26	13.1% / 28	16.2% / 36	17.3% / 39	15.7% / 36	15.7% / 36	13.5% / 31
	%/# of "uncertain" stocks	36.1% / 70	40.7 % / 87	41.9 % / 93	41.6% / 94	41.0% / 94	41.7% / 96	43.5% / 100
2. Stocks going from uncertain to certain status (or vice versa) in the past year	# of stocks that went from uncertain status to known status†	Baseline year	4	7	6	6	0	2
	# of stocks that went from known status to uncertain status†	Baseline year	6	8	4	4	1	8
3. Change in status from previous year	%/# of stocks that have changed status†	Baseline year	10.8% / 21††	12.6% / 27††	11.7% / 26††	9.7% / 22††	1.3% / 3††	11.7% / 27††
	# of stocks whose status improved †	Baseline year	5	2	5	9	1	11
	# of stocks whose status worsened †	Baseline year	6	10	11	3	1	6
	%/# of stocks whose status remained the same†	Baseline year	89.2% / 173††	87.4% / 187††	88.3% / 196††	90.3% / 204††	98.7% / 228††	88.2% / 203††
4. Biomass/abundance known	%/# of stocks with recent (≤ 5 years) biomass/abundance estimates	64.9% / 126	64.0% / 137	59.5% / 132	59.7% / 135	56.8% / 130	53.5% / 123	50.0% / 115

[18] Excluding marine mammals, diadromous fish, and freshwater fish

Indicator	Details	2017	2018	2019	2020	2021	2022	2023
	%/# of stocks without recent assessments (n=115 in 2023) that have had interim updates of indicators since their last complete assessment	Not available — new indicator	Not available — new indicator	21.1% / 19	22.0% / 20	22.2% / 22	23.8% / 25	24.3% / 28
5. Sources of mortality known*	%/# of stocks with fishing mortality (F) known	20.6 % / 40	16.8 % / 36	18.0 % / 40	18.1% / 41	18.3% / 42	18.3% / 42	20.4% / 47
	# of stocks that clearly incorporate all sources of F in its estimation	Not available — new indicator	Not available — new indicator	2	2	2	4	4
	%/# of stocks with natural mortality (M) known	Not available — new indicator	14.5% / 31	17.1% / 38	19.9% / 45	21.8% / 50	25.2% / 58	27.0% / 62
	%/# of stocks with total mortality (Z) known	Not available — new indicator	6.1% / 13	8.1% / 18	10.6% / 24	11.8% / 27	11.8% / 27	11.3% / 26
	%/# of stocks with exploitation rate known	Not available — new indicator	Not available — new indicator	39.2% / 87	45.1% / 102	48.0% / 110	48.0% / 110	48.3% / 111
	%/# of stocks with landings known	Not available — new indicator	Not available — new indicator	96.4% / 214	96.9% / 219	97.4% / 223	97.4% / 224	97.4% / 224
6. Reference points	%/# of stocks with limit reference points	53.6% / 104	57.0% / 122	61.3% / 136	60.2% / 136	62.0% / 142	60.4% / 139	59.6% / 137

Indicator	Details	2017	2018	2019	2020	2021	2022	2023
	%/# of stocks with upper stock reference points	42.3% / 82	43.0% / 92	44.1% / 98	44.7% / 101	45.4% / 104	44.3% / 102	47.4% / 109
7. Management plans in place	%/# of stocks in an Integrated Fisheries Management Plan	71.1% / 138	72.0% / 154	88.7% / 197	88.9% / 201	88.2% / 202	87.8% / 202	89.1% / 205
8. Catch monitoring	%/# of stocks with at-sea/electronic monitoring	Yes — 100% 21.1% / 41	Yes — 100% 21.0% / 45	Yes — 100% 22.1% / 49	Yes — 100% 22.1% / 50	Yes — 100% 21.8% / 50	Yes — 100% 21.7% / 50	Yes — 100% 18.3% / 42
		Yes — coverage varies or level is uncertain 50.0% / 97	Yes — coverage varies or level is uncertain 49.1% / 105	Yes — coverage varies or level is uncertain 59.9% / 133	Yes — coverage varies or level is uncertain 59.7% / 135	Yes — coverage varies or level is uncertain 62.4% / 143	Yes — coverage varies or level is uncertain 62.2% / 143	Yes — coverage varies or level is uncertain 66.0% / 152
		Uncertain 28.9% / 56	Uncertain 29.9% / 64	Uncertain 18.0% / 40	Uncertain 18.1% / 41	Uncertain 15.7% / 36	Uncertain 16.1% / 37	Uncertain 15.7% / 36
	%/# of stocks with logbooks	Yes — and bycatch species are recorded 21.6% / 42	Yes — and bycatch species are recorded 27.1% / 58	Yes — and bycatch species are recorded 28.8% / 64	Yes — and bycatch species are recorded 30.5% / 69	Yes — and bycatch species are recorded 36.2% / 83	Yes — and bycatch species are recorded 38.7% / 89	Yes — and bycatch species are recorded 41.7% / 96
		Yes — but unclear if bycatch species are recorded 60.8% / 118	Yes — but unclear if bycatch species are recorded 55.1% / 118	Yes — but unclear if bycatch species are recorded 67.1% / 149	Yes — but unclear if bycatch species are recorded 65.5% / 148	Yes — but unclear if bycatch species are recorded 59.4% / 136	Yes — but unclear if bycatch species are recorded 57.0% / 131	Yes — but unclear if bycatch species are recorded 53.5% / 123
		Uncertain 17.5% / 34	Uncertain 17.8% / 38	Uncertain 4.1% / 9	Uncertain 4.0% / 9	Uncertain 4.4% / 10	Uncertain 4.3% / 10	Uncertain 4.8% / 11

Indicator	Details	2017	2018	2019	2020	2021	2022	2023
	%/# of stocks with dockside monitoring	Yes — 100% 40.2% / 78	Yes — 100% 44.9% / 96	Yes — 100% 62.6% / 139	Yes — 100% 58.8% / 133	Yes — 100% 60.3% / 138	Yes — 100% 60.4% / 139	Yes — 100% 63.0% / 145
		Yes — coverage varies or level is uncertain 34.0% / 66	Yes — coverage varies or level is uncertain 28.5% / 61	Yes — coverage varies or level is uncertain 23.0% / 51	Yes — coverage varies or level is uncertain 27.0% / 61	Yes — coverage varies or level is uncertain 25.8% / 59	Yes — coverage varies or level is uncertain 25.2% / 58	Yes — coverage varies or level is uncertain 22.6% / 52
		Uncertain 25.8% / 50	Uncertain 26.6% / 57	Uncertain 14.4% / 32	Uncertain 14.2% / 32	Uncertain 14.0% / 32	Uncertain 14.3% / 33	Uncertain 14.3% / 33
	%/# of stocks with electronic vessel monitoring systems (VMS)/automated identification systems (AIS)	Not available — new indicator	Not available — new indicator	Yes — 100% of vessels always 32.4% / 72	Yes — 100% of vessels always 33.6% / 76	Yes — 100% of vessels always 34.5% / 79	Yes — 100% of vessels always 34.3% / 79	Yes — 100% of vessels always 28.7% / 66
		Not available — new indicator	Not available — new indicator	Yes — some vessels but not all vessels 18.0% / 40	Yes — some vessels but not all vessels 20.8% / 47	Yes — some vessels but not all vessels 19.2% / 44	Yes — some vessels but not all vessels 19.6% / 45	Yes — some vessels but not all vessels 27.4% / 63
		Not available — new indicator	Not available — new indicator	Yes — but uncertain if all vessels or all times 8.1% / 18	Yes — but uncertain if all vessels or all times 5.8% / 13	Yes — but uncertain if all vessels or all times 6.1% / 14	Yes — but uncertain if all vessels or all times 6.1% / 14	Yes — but uncertain if all vessels or all times 12.6% / 29
		Not available — new indicator	Not available — new indicator	Uncertain 20.7% / 46	Uncertain 19.9% / 45	Uncertain 20.5% / 47	Uncertain 20.4% / 47	Uncertain 14.8% / 34

Indicator	Details	2017	2018	2019	2020	2021	2022	2023
		Not available — new indicator	Not available — new indicator	No 20.7% / 46	No 19.9% / 45	No 19.7% / 45	No 19.6% / 45	No 16.5% / 38
	%/# of stocks with specific catch monitoring objectives in their IFMP	Not available — new indicator	Not available — new indicator	0.0% / 0	0.0% / 0	0.0% / 0	0.0% / 0	0.4% / 1
9. Critical stocks with rebuilding plans	%/# of critical zone stocks (n=31 in 2023) with rebuilding plans	11.5% / 3	10.7% / 3	16.7 % / 6	15.4% / 6	19.4% / 7	19.4% / 7	19.4% / 7

† *The "all stocks" dataset changes each year as stocks are added during the update process. To calculate the percentage change from the previous year, Oceana Canada used the previous year's "all stocks dataset," excluding new stocks added during the update.*
†† *This value includes those that changed status to or from uncertain.*
* *Sometimes it is not possible to estimate mortality with available data or models.*

Appendix 1: Figures of select indicators by Fisheries and Oceans Canada (DFO) administrative regions

In addition to the National Capital Region based in Ottawa, DFO currently has seven administrative regions across the country,[19] each responsible for the management of fisheries and oceans within their jurisdiction (Figure A1):

1. Newfoundland and Labrador
2. Maritimes
3. Gulf
4. Quebec
5. Arctic
6. Ontario and Prairie
7. Pacific

The following pages provide visualizations of the Fishery Audit index dataset (n = 194 stocks) by taxa group within each DFO region (Figure A2) and select indicator values summarized by region in each year available (Figures A3 to A16).

[19] Source: DFO (2021). Regions. Fisheries and Oceans Canada. http://www.dfo-mpo.gc.ca/regions/index-eng.htm

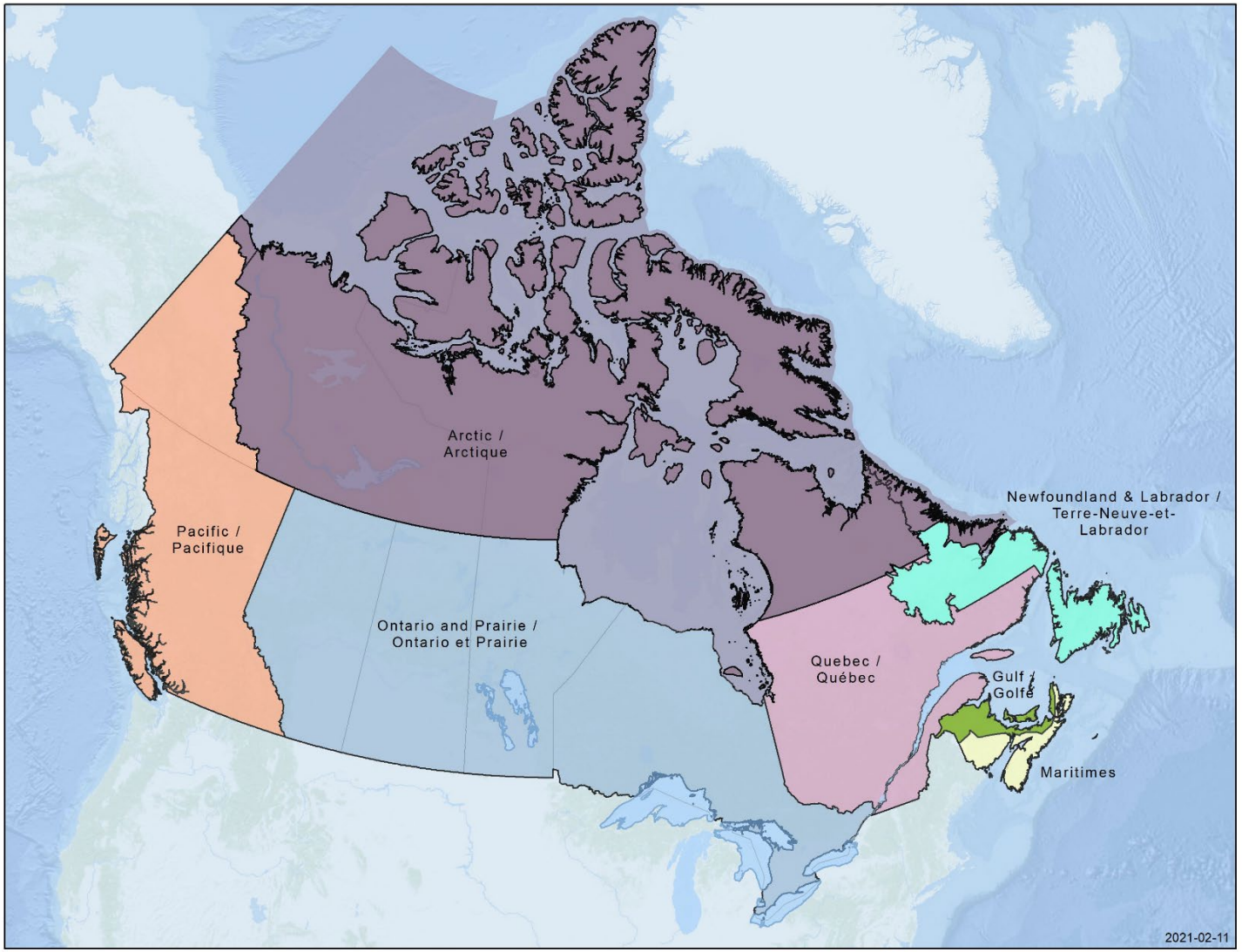

Figure A1. Map of DFO administrative regions. Modified from: https://www.dfo-mpo.gc.ca/about-notre-sujet/organisation-eng.htm

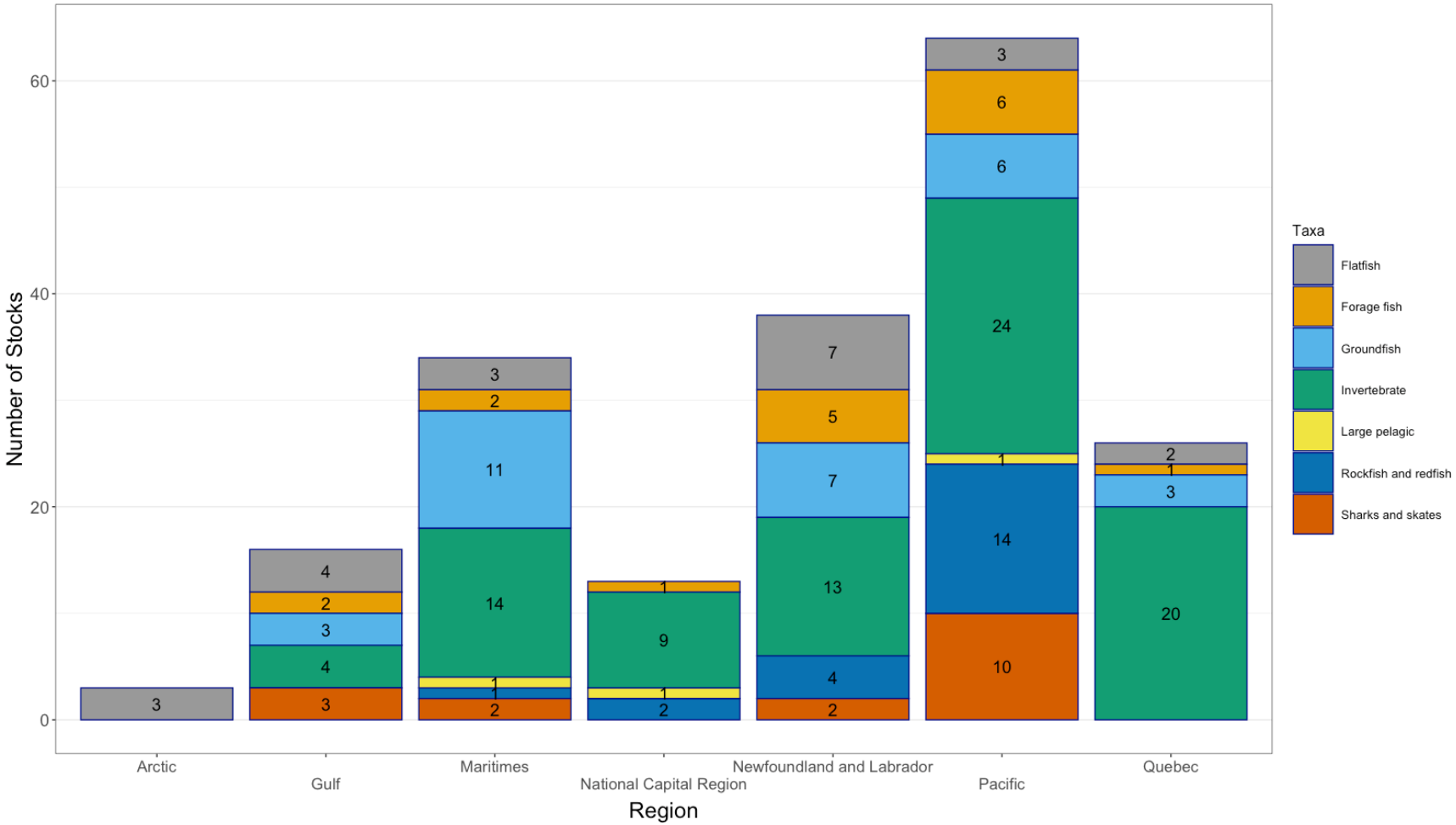

Figure A2. The number of Oceana Canada index stocks (n = 194 stocks) within each DFO administrative region and taxa group. The number of stocks in each region-taxa combination is reported in black font within the bars.

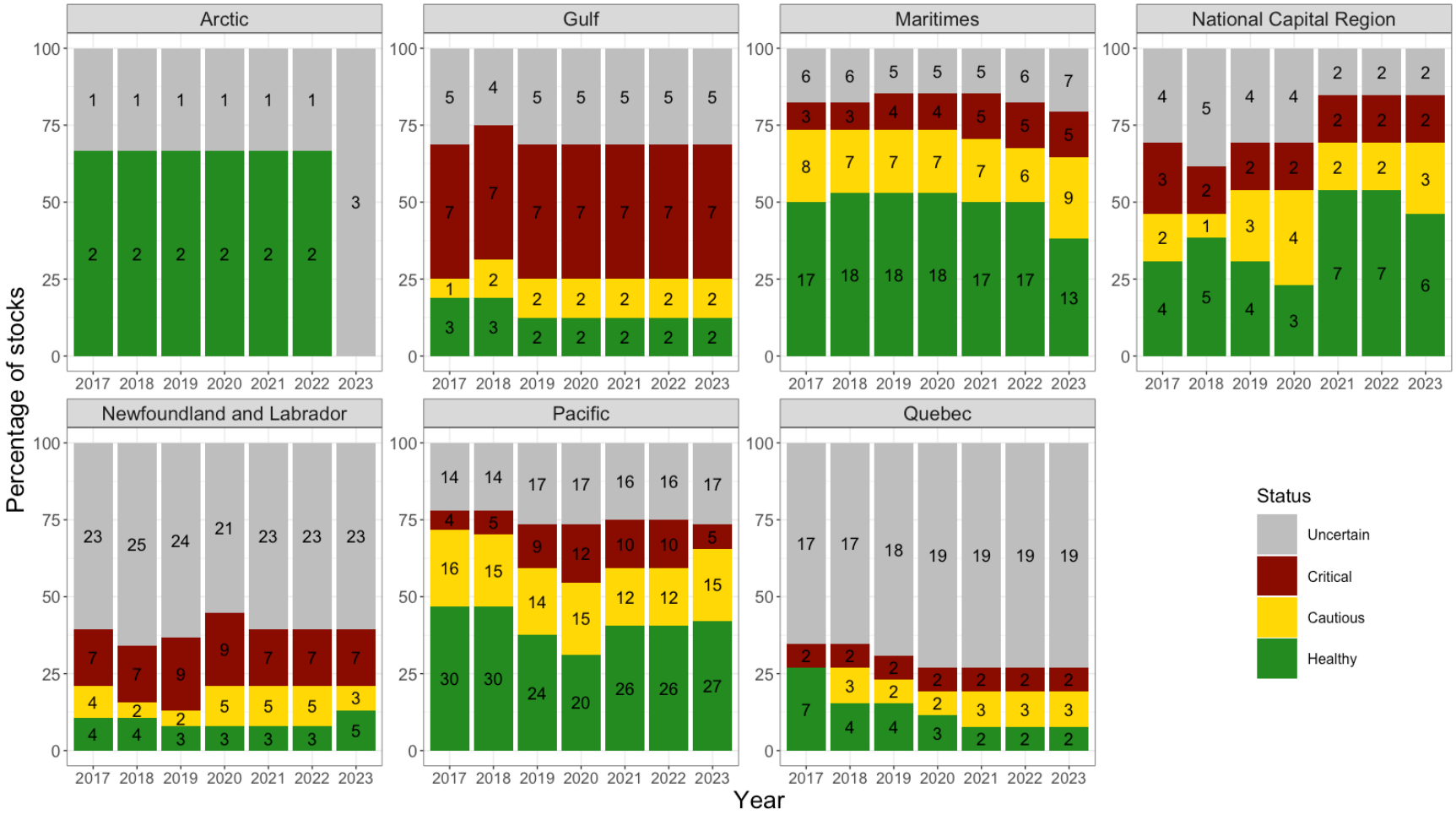

Figure A3. The percentage of Oceana Canada index stocks in each of DFO's health status zones defined under the precautionary approach (PA) framework in each DFO administrative region from 2017 to 2023. The number of stocks in each year-region-status combination is reported in black font within the bars.

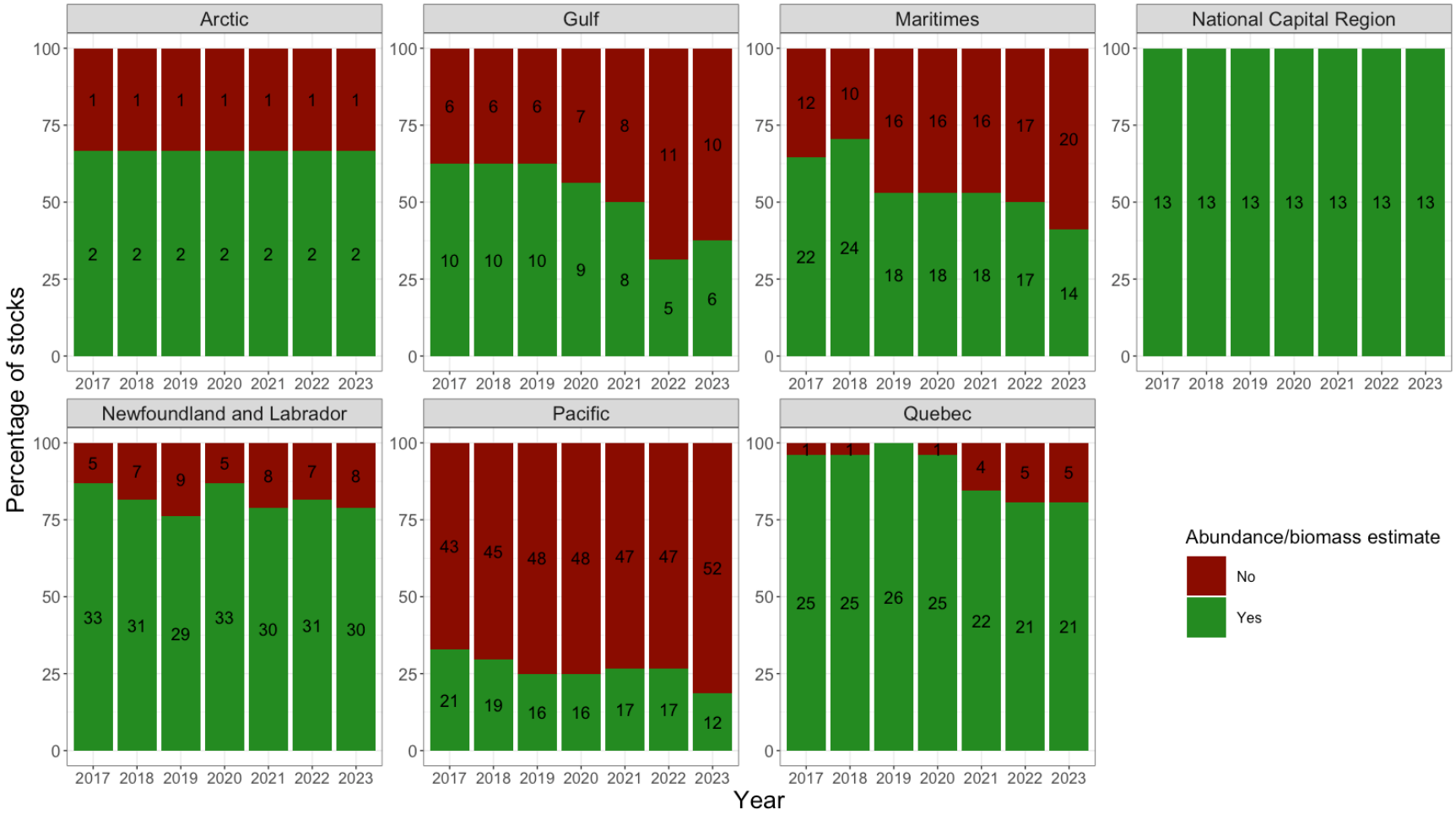

Figure A4. The percentage of Oceana Canada index stocks with recent (≤ 5 years old) biomass or abundance estimates in each DFO administrative region from 2017 to 2023. The number of stocks in each year-region-category combination is reported in black font within the bars.

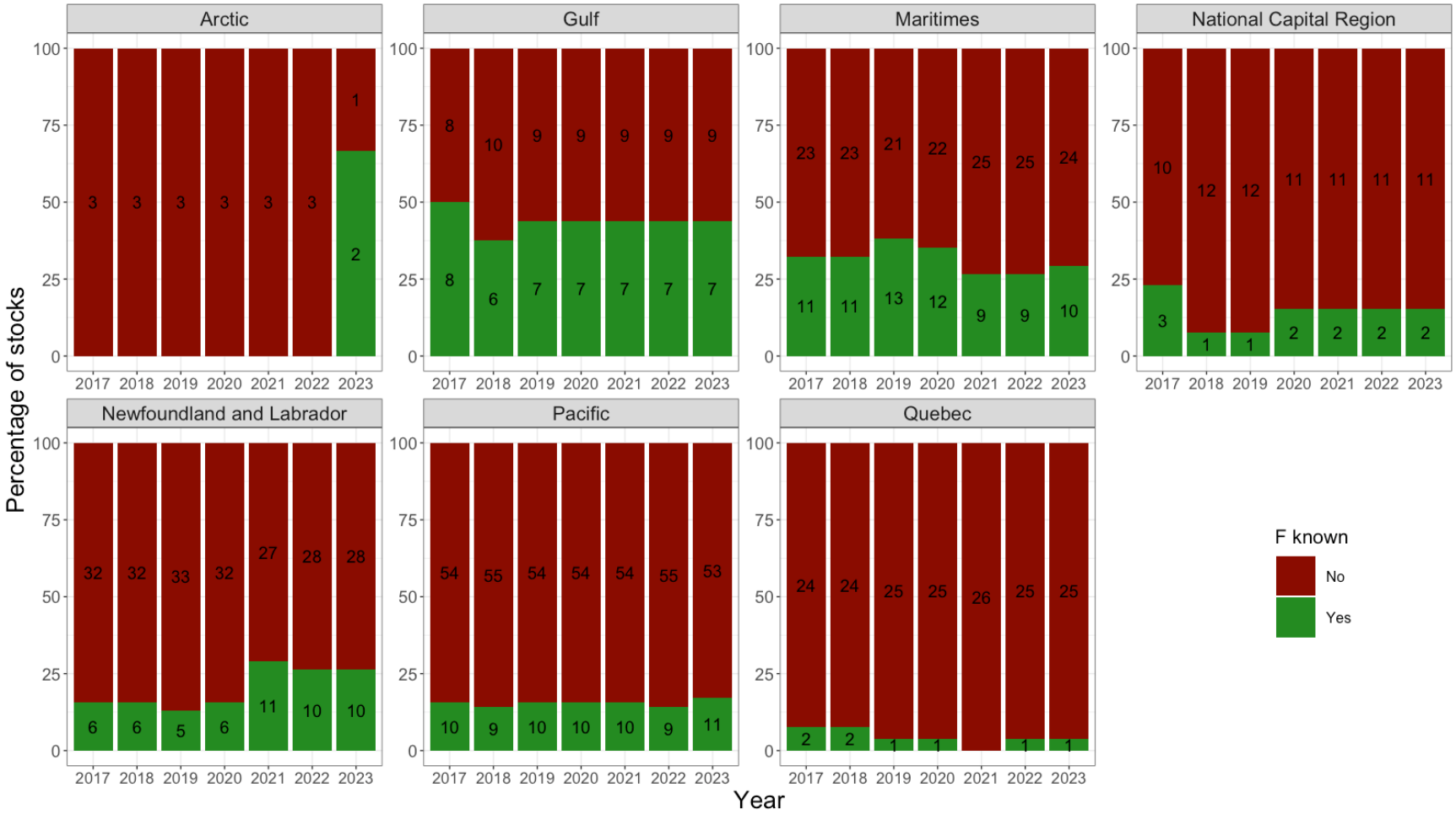

Figure A5. The percentage of Oceana Canada index stocks with fishing mortality (F) estimates in each DFO administrative region from 2017 to 2023. The number of stocks in each year-region-category combination is reported in black font within the bars.

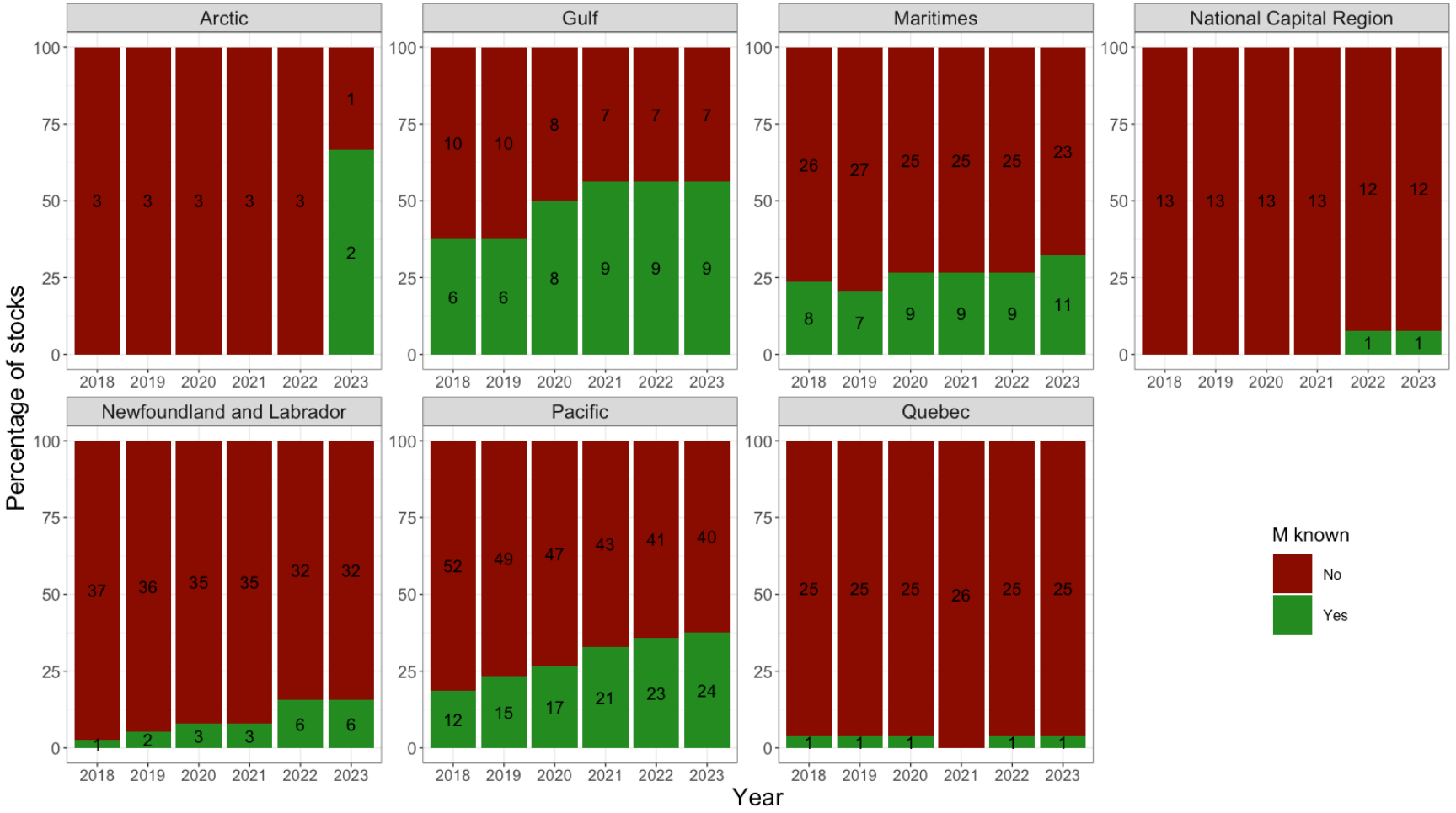

Figure A6. The percentage of Oceana Canada index stocks with natural mortality (M) estimates in each DFO administrative region in 2018-2023. The number of stocks in each year-region-category combination is reported in black font within the bars. Please note this indicator was added in 2018.

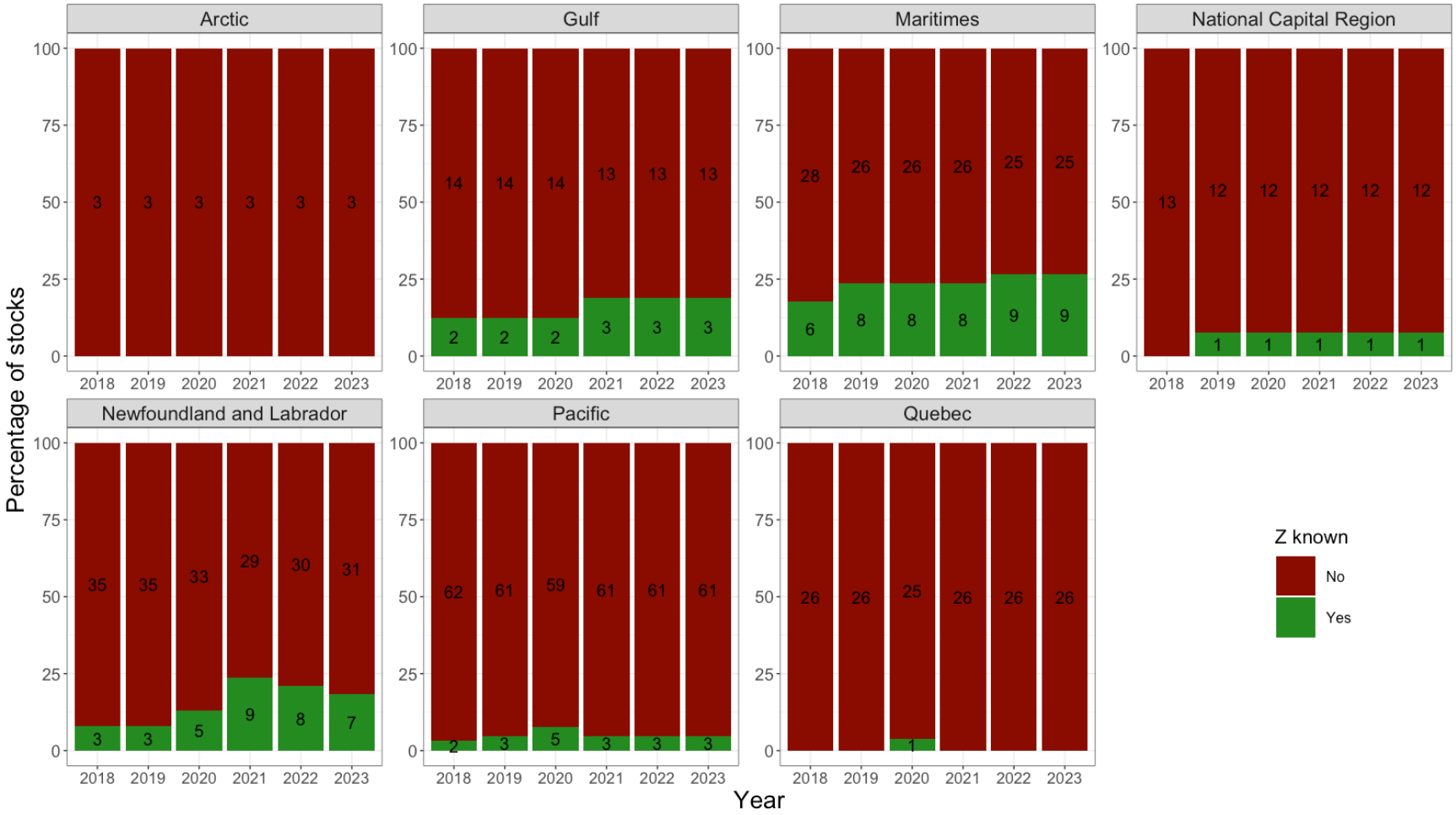

Figure A7. The percentage of Oceana Canada index stocks with total mortality (Z) estimates in each DFO administrative region from 2018 to 2023. The number of stocks in each year-region-category combination is reported in black font within the bars. Please note this indicator was added in 2018.

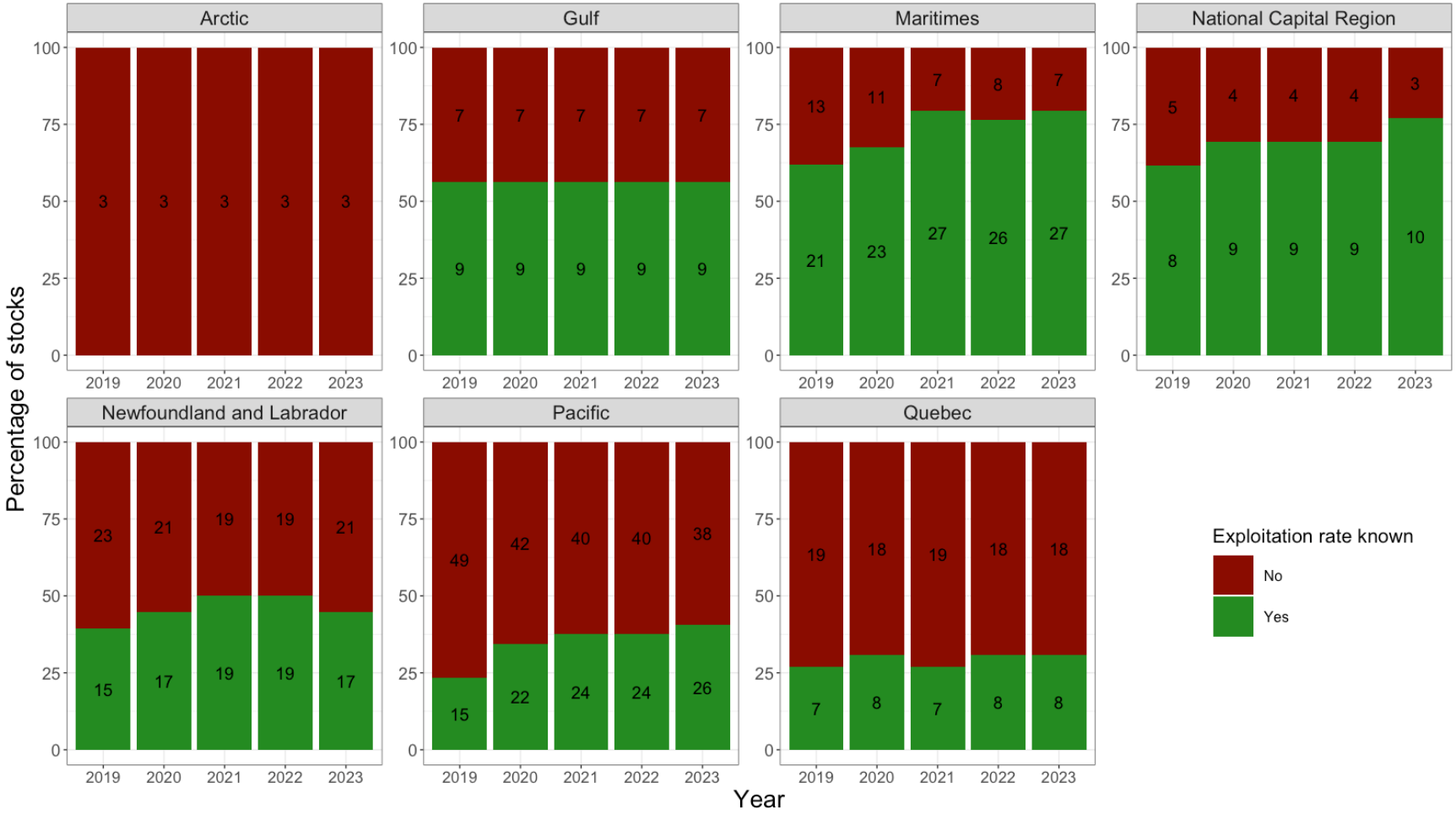

Figure A8. The percentage of Oceana Canada index stocks with exploitation rate estimates in each DFO administrative region in 2019-2023. The number of stocks in each region-category combination is reported in black font within the bars. Please note this indicator was added in 2019.

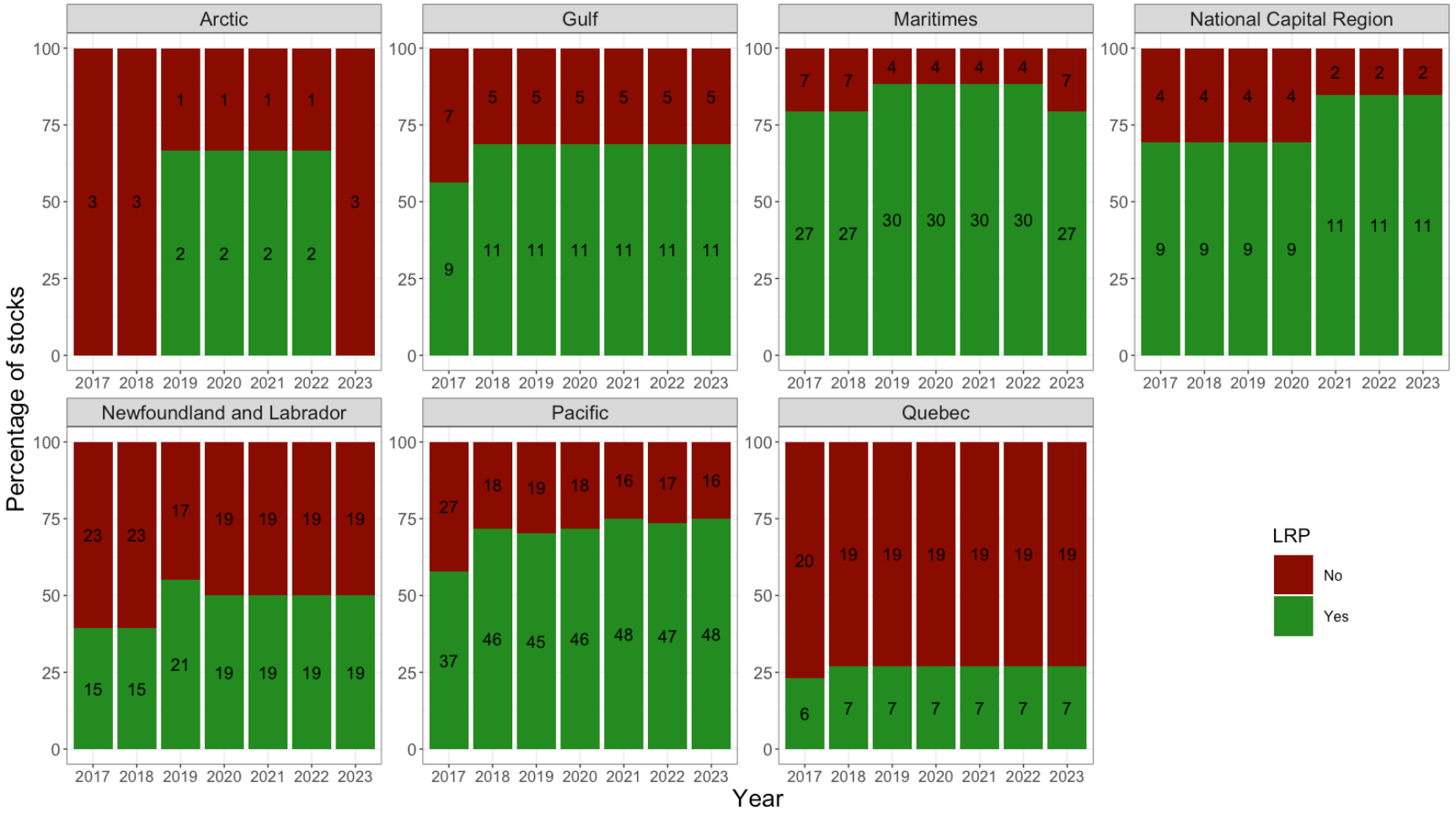

Figure A9. The percentage of Oceana Canada index stocks with limit reference points (LRPs) in each DFO administrative region from 2017 to 2023. The number of stocks in each year-region-category combination is reported in black font within the bars.

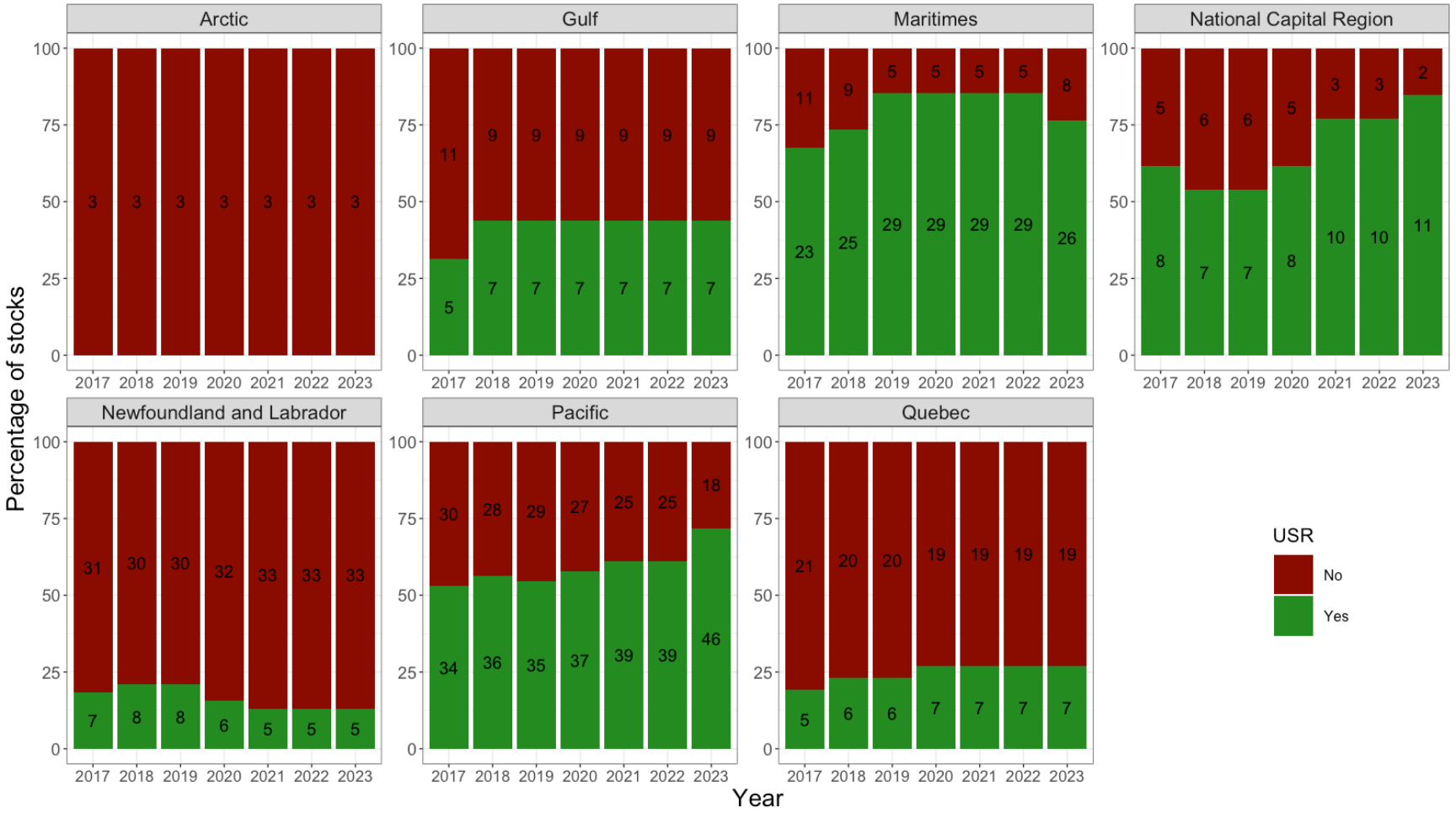

Figure A10. The percentage of Oceana Canada index stocks with upper stock reference points (USRs) in each DFO administrative region from 2017 to 2023. The number of stocks in each year-region-category combination is reported in black font within the bars.

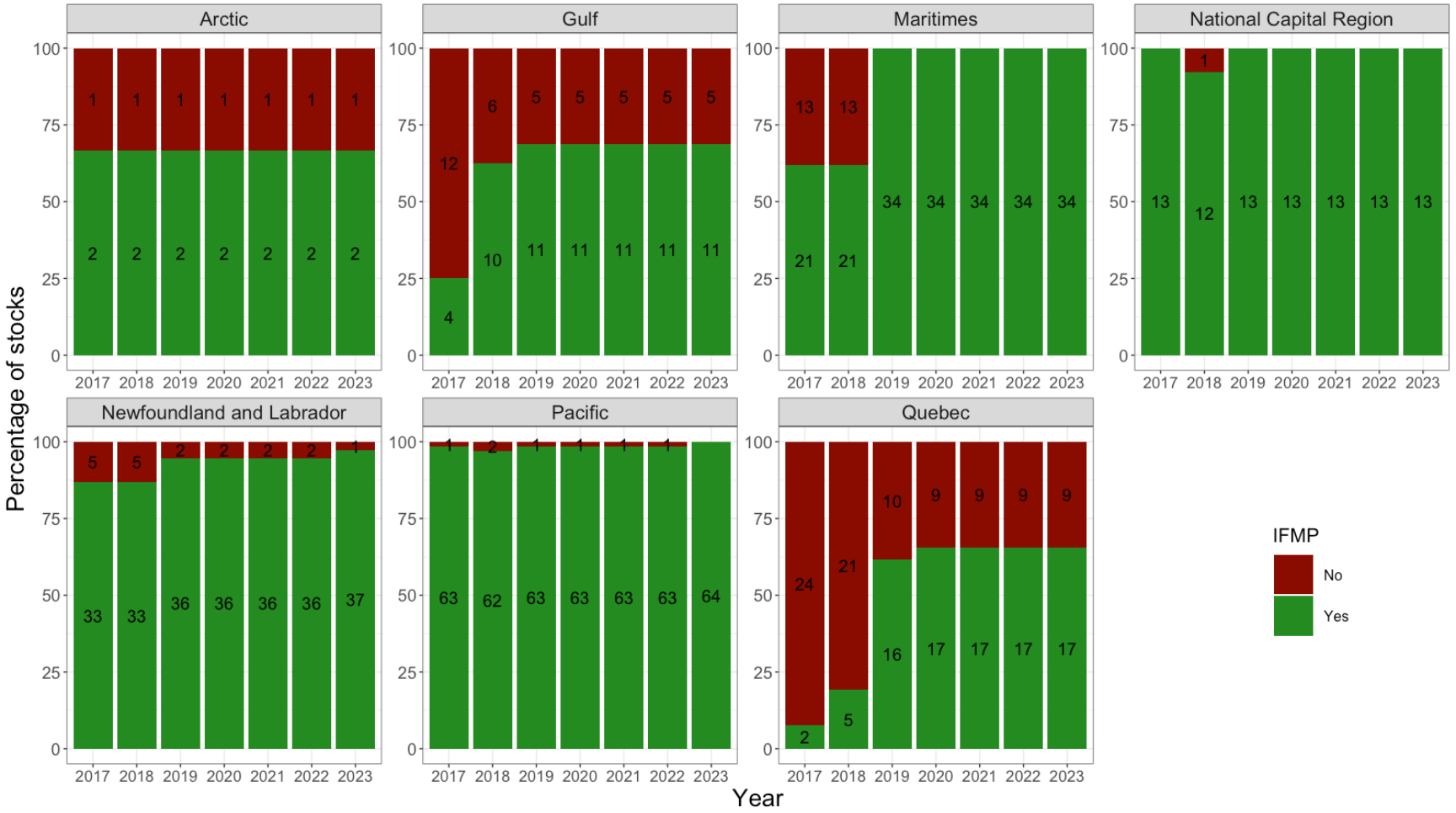

Figure A11. The percentage of Oceana Canada index stocks included in Integrated Fisheries Management Plans (IFMPs) in each DFO administrative region from 2017 to 2023. The number of stocks in each year-region-category combination is reported in black font within the bars.

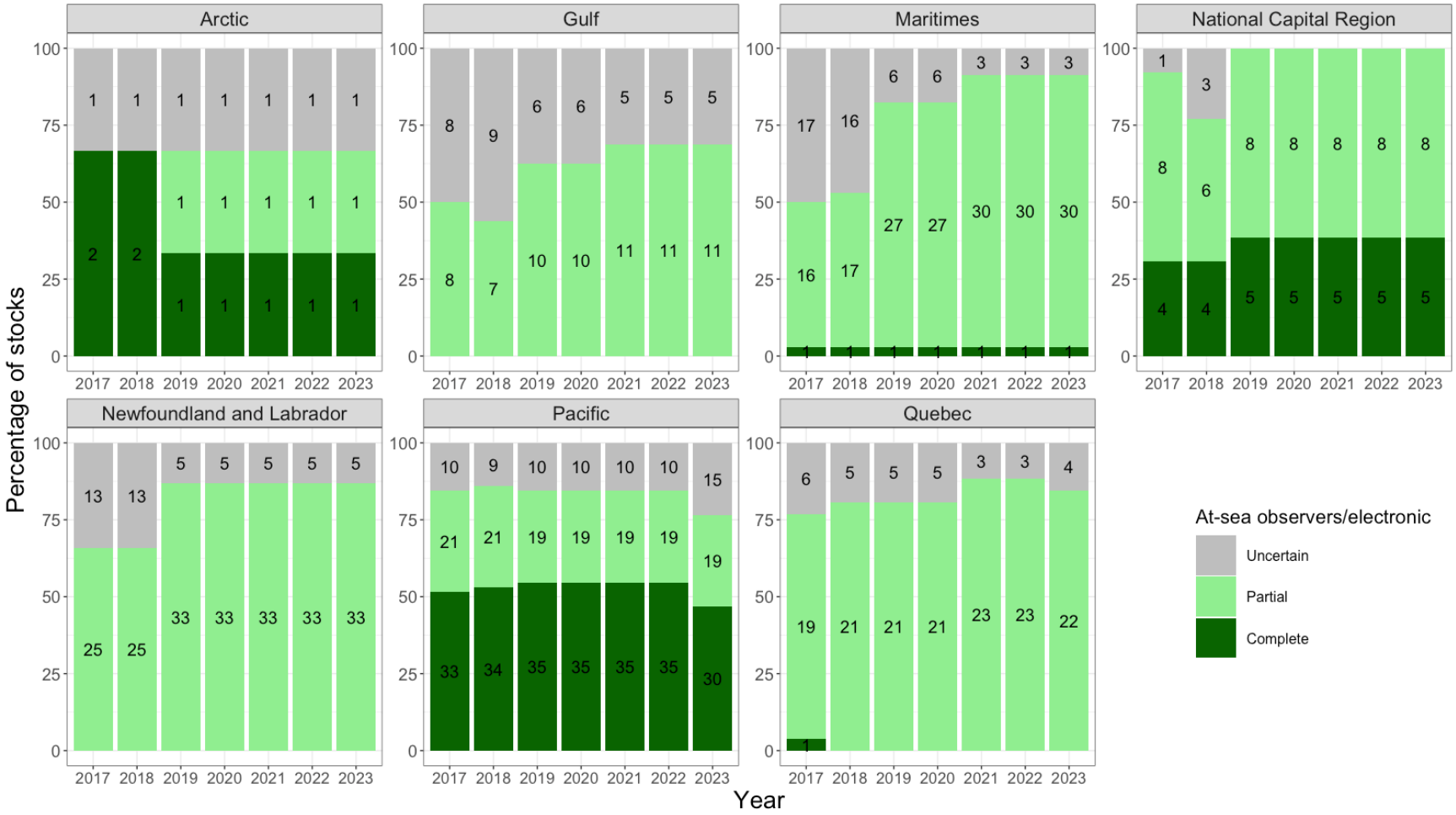

Figure A12. The percentage of Oceana Canada index stocks that have at-sea observer or electronic (i.e., video) monitoring in each DFO administrative region from 2017 to 2023. The number of stocks in each year-region-category combination is reported in black font within the bars. "Uncertain" was assigned when the documents and websites searched provided no indication that the use of the monitoring tool was required. "Partial" was assigned when it was clearly indicated the monitoring tool was required but levels of targeted tool use varied or were uncertain. "Complete" was assigned when it was clearly indicated the monitoring tool is required on 100 per cent of fishing trips. It should be noted, 100 per cent coverage for at-sea observers or electronic monitoring is not necessary for all fisheries.

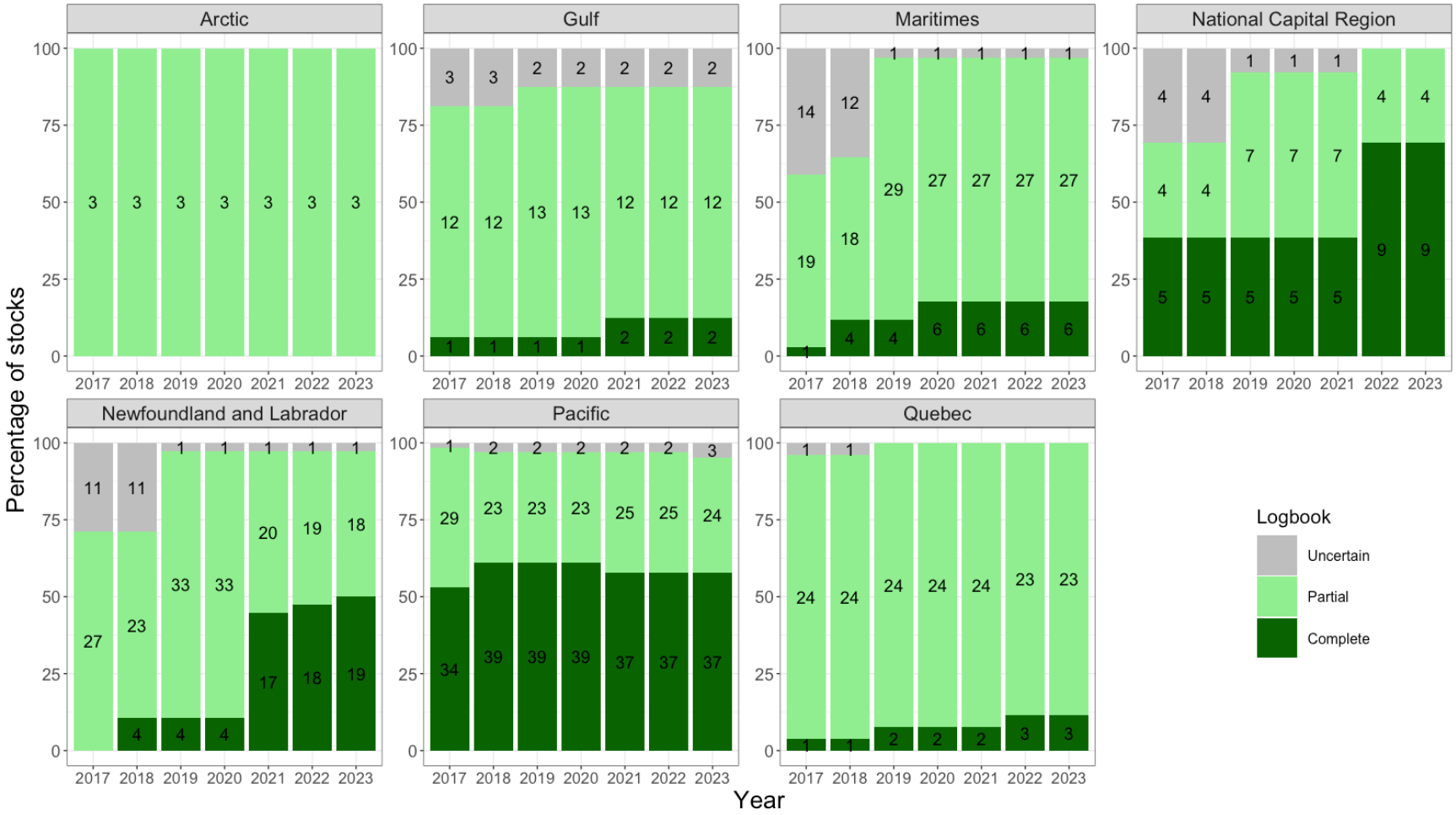

Figure A13. The percentage of Oceana Canada index stocks that require logbooks recording the entire catch (i.e., directed species and bycatch) in each DFO administrative region from 2017 to 2023. The number of stocks in each year-region-category combination is reported in black font within the bars. "Uncertain" was assigned when there was no indication in the documents and websites searched that the use of the monitoring tool is required. "Partial" was assigned when it was clearly indicated the monitoring tool was required but it was unclear if bycatch is recorded. "Complete" was assigned when it was clearly indicated that recording both directed catch and bycatch is required.

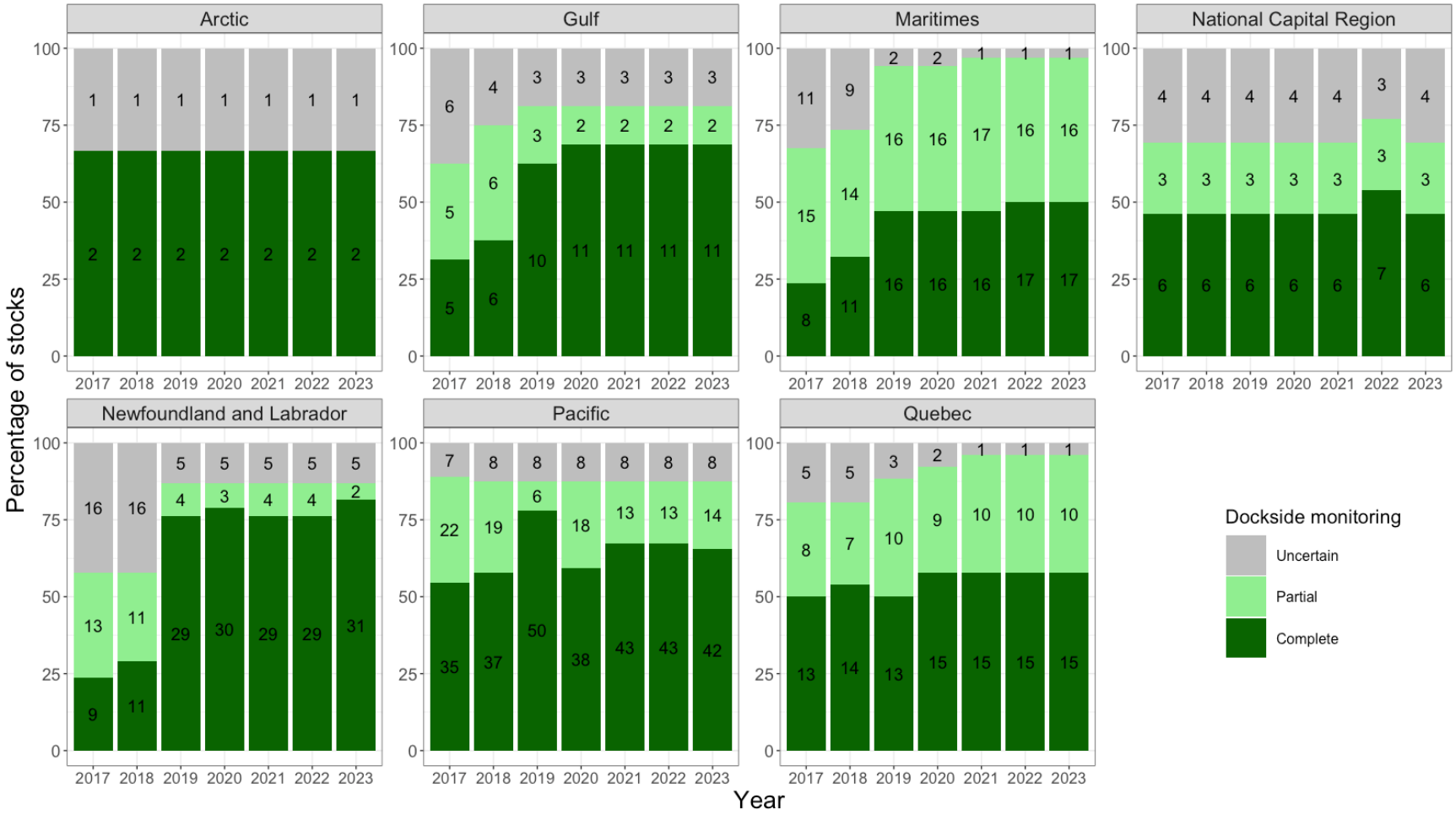

Figure A14. The percentage of Oceana Canada index stocks that have independent dockside monitoring in each DFO administrative region from 2017 to 2023. The number of stocks in each year-region-category combination is reported in black font within the bars. "Uncertain" was assigned when there was no indication in the documents and websites searched that the use of the monitoring tool is required. "Partial" was assigned when it was clearly indicated the monitoring tool was required but targeted levels of tool use varied or were uncertain. "Complete" was assigned when it was clearly indicated the monitoring tool is required on 100 per cent of fishing trips.

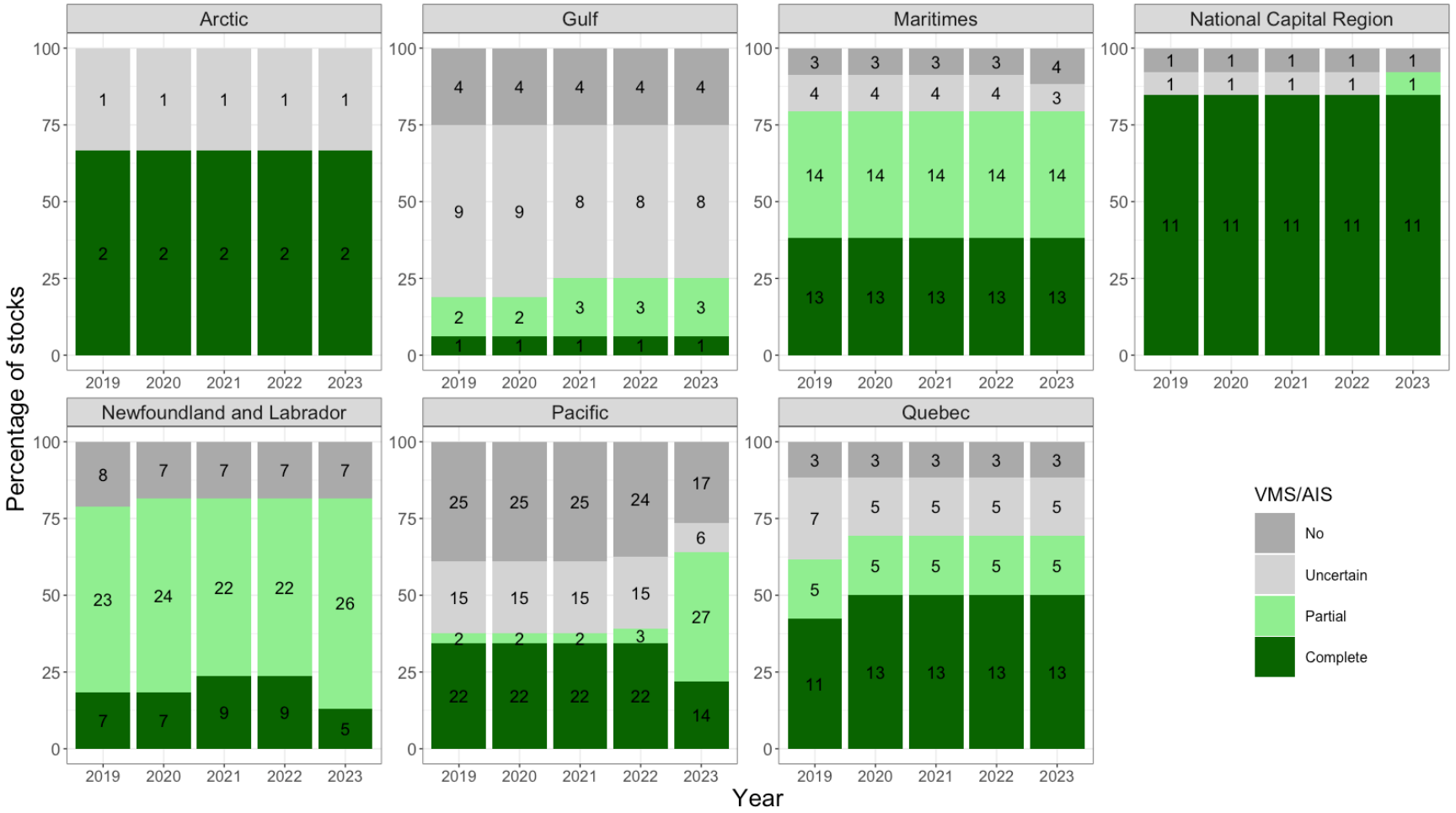

Figure A15. The percentage of Oceana Canada index stocks that have vessels requiring electronic location monitoring, either via vessel monitoring systems (VMS) or automated identification systems (AIS), in each DFO administrative region in 2019, 2020, 2021, and 2022. The number of stocks in each region-category combination is reported in black font within the bars. "Uncertain" was assigned when there was no indication in the documents and websites searched that the use of the monitoring tool is required. "Partial" was assigned when it was clearly indicated the monitoring tool was required but targeted levels of tool use varied or were uncertain. "Complete" was assigned when it was clearly indicated the monitoring tool is required on 100 per cent of fishing vessels and trips. "No" was assigned when it was clearly indicated VMS or AIS was not required. It should be noted, 100 per cent coverage for electronic location monitoring is not necessary for all fisheries (e.g., shore-based fisheries without vessels). Please note this indicator was added in 2019.

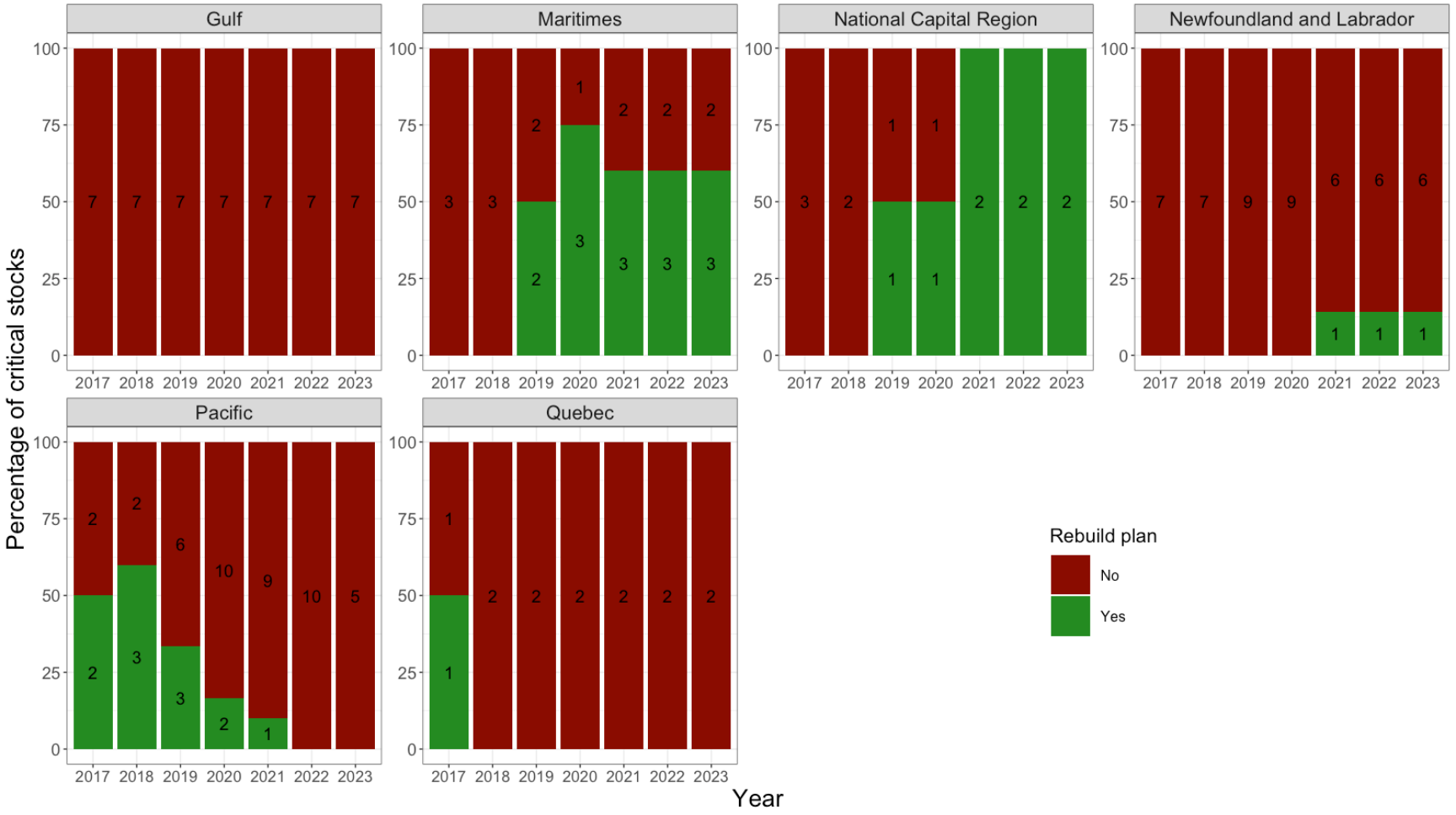

Figure A16. The percentage of Oceana Canada index stocks in the critical zone and included in rebuilding plans in each DFO administrative region from 2017 to 2023. The number of stocks in each year-region-category combination is reported in black font within the bars. Please note the number and composition of critical zone stocks within each region may change from year to year. Note this figure does not display rebuilding plans in place for stocks that are no longer in the critical zone.