

The Quality of Current and Future Rebuilding Plans in Canada

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Rebuilding our depleted fisheries is critical to restoring the health of Canada's oceans and maintaining and strengthening our coastal communities that depend on them. When developed properly, rebuilding plans are transparent roadmaps of the rebuilding process, operationalizing strategies to increase the potential for rebuilding depleted fish and invertebrate stocks (Garcia et al. 2018, OECD 2012, Oceana Canada 2017). Rebuilding plan development requires carefully evaluating the reasons for depletion and the impediments to rebuilding and co-developing management measures to promote rebuilding with fishery rights-holders and stakeholders (see Figure 1 for an overview of the process for developing and implementing a rebuilding plan). According to a recent Food and Agricultural Organization (FAO) report, rebuilding "...is an "extra-ordinary" fishery management strategy developed for the specific purpose of restoring the resources and the fishery" (Garcia et al. 2018). Fisheries and Oceans Canada (DFO) has recently committed to developing rebuilding plans for several depleted stocks (DFO 2017a, 2018a, 2019a), accelerating implementation of a long-standing policy requirement (DFO 2009).

The importance of rebuilding was further acknowledged by the federal government this year, when it [passed a modernized Fisheries Act](#) that includes a requirement to develop rebuilding plans for major fish stocks depleted to or below their limit reference points (LRPs) (House of Commons of Canada 2019), the point below which serious harm is occurring to a stock (DFO 2009). Canada now has a legal obligation to rebuild depleted fish stocks, strengthen the current management framework and accelerate stagnant policy implementation. The new requirements offer greater potential for our depleted fish stocks to rebuild, contribute to more resilient ecosystems and provide long-term economic prosperity for our fishing communities. It is important to note that key components required in the creation of rebuilding plans will be developed in regulations, including identification of the stocks to which the law will apply (DFO 2018b, Elmslie 2019).

This document evaluates the government's current draft regulation requirements for rebuilding plans and how well existing plans meet them, highlighting further improvements required to ensure comprehensive rebuilding plans are developed moving forward. First, the proposed timelines to develop rebuilding plans are evaluated, followed by each of the five proposed government requirements for rebuilding plans. Other important additional rebuilding plan content is discussed, followed by recommendations that, if implemented, will ensure rebuilding plans developed moving forward meet global best practices, offer greater potential for our depleted fish stocks to rebuild and contribute to more resilient ecosystems, and provide long-term economic prosperity for our coastal fishing communities.

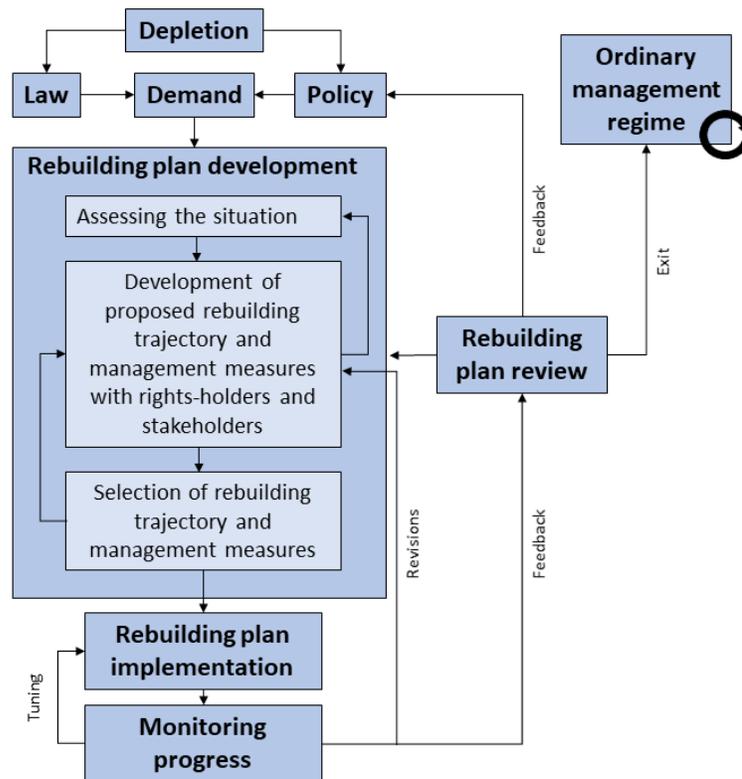


Figure 1. Flow diagram of a sample process for developing and implementing a rebuilding plan (modified from Figure 35 in Garcia et al. 2018). Rebuilding is connected to the ordinary management regime and starts when a stock is depleted below a reference level that triggers the development of a rebuilding plan, often required by policy or law. Rebuilding plan development begins with an initial assessment of the situation. This is followed by the development of proposed rebuilding trajectories with rights-holders and stakeholders. This includes setting abundance targets and the timelines and management measures required to achieve them. A final trajectory is chosen, often requiring trade-offs among biological and socio-economic objectives. Rebuilding plan implementation, monitoring and review are interconnected and requires adaptive management that responds to progress towards rebuilding. Once the target abundance is achieved with certainty, management can return to the ordinary regime, which should be modified from lessons learned during rebuilding to ensure preventable depletion does not occur again.

PROPOSED TIMELINES TO DEVELOP REBUILDING PLANS

The draft regulations indicate rebuilding plans must be put in place within 24 months after the Minister determines that a listed stock has declined to or below its LRP (DFO 2018b). This may be extended to 36 months if additional time is required to collect further scientific information, seek feedback from Indigenous peoples or discuss management measures for a shared stock with other jurisdictions. There will be a trade-off between the time required to develop an effective plan and promptly responding to stock decline. As indicated by DFO rebuilding plan guidelines (DFO 2013), rebuilding plan development can take considerable time and should be initiated well in advance to ensure it is ready to come into effect when a stock reaches the boundary between the critical and cautious zones.

Currently, there are seven critically depleted marine fish and invertebrate stocks in Canada included in publicly available rebuilding plans (Table 1; DFO 2018c, 2019b, 2019c, 2019d, 2019e). Meanwhile, there are at least 27 more stocks depleted below their LRP and 30 more in the cautious zone (Oceana Canada 2019), indicating many more stocks require inclusion in rebuilding plans. It is difficult to determine when the development of current rebuilding plans was initiated, as the plans do not always indicate the development start date.

Given there are no specific timelines associated with rebuilding plan development under current policy (as is evident by the number of critical zone stocks without rebuilding plans), the time needed to develop these plans should not be extrapolated to any new plans developed under the proposed draft regulations. This data can, however, provide insight into the time required to develop rebuilding plans. Comparing when existing rebuilding plans were first made publicly available to when the first assessment that indicated the stock had declined to or below its LRP yields a wide range: from almost 10 years to under five months¹ (Table 2). Two rebuilding plans, those for yelloweye rockfish (outside population) and northern shrimp (in shrimp fishing area 6), were completed within 24 months of the assessment showing the stock was below its LRP, indicating the draft regulation timeline is feasible (Box 1). For these regulations to be implemented as intended, however, LRPs must be in place for all stocks to which the regulations apply. Currently, about a third of marine fish and invertebrate stocks lack LRPs (Oceana Canada 2019). It is imperative that LRPs are developed for all stocks, to ensure health status can be assessed and stocks requiring rebuilding plans identified quickly.

The draft regulations have proposed the development of rebuilding plans should be complete within 24 and 36 months. This is reasonable since it has been accomplished in the past and is similar to requirements for the development of recovery strategies and management plans under Canada's *Species at Risk Act* (one to five years, depending on when the species was listed under the Act and its risk category) (Canada 2002). That said, waiting until the stock is assessed and found to have declined to or below its LRP should be a last resort. Rebuilding plans should start to be developed when stocks are declining in the lower cautious zone. This would be consistent with established DFO rebuilding guidelines (DFO 2013) and recent statements from the Minister about the intention of the proposed rebuilding requirements at the Senate Standing Committee on Fisheries and Oceans (POFO 2019), where he stated: "*Those [stocks] that require rebuilding plans are those that are not healthy or in the high part of cautious. **Everything else will require a rebuilding plan** [emphasis added].*" Rebuilding plans are also important for stocks that have recently grown from the critical zone to the cautious zone without a rebuilding plan, to guide the development of a sustainable fishery and ensure the stock does not decline again into the critical zone.

¹ The calculation could not be determined for one stock, Yellowtail flounder on Georges Bank, due to the lack of an established LRP.

Box 1: Current rebuilding plans developed within the proposed timelines

Yelloweye rockfish - Outside population: The shortest time required to develop a rebuilding plan was for the yelloweye rockfish outside population. It took approximately five months from the time it was determined the stock was below the LRP to public availability of the rebuilding plan (Table 2). This population was first noted as being in the critical zone during a stock assessment meeting held in September 2015 (DFO 2015), and the rebuilding plan was published in February 2016 (DFO 2016). This short timeline likely belies the amount of work conducted prior to the stock officially being declared in the critical zone at the assessment in 2015. Declines in yelloweye rockfish in waters adjacent to British Columbia were noted at least as early as 2001 (Yamanaka and Lacko 2004), and the stock was assessed as “special concern” by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2008 (COSEWIC 2008). The stock was not assessed frequently and therefore was not officially declared as in the critical zone until the 2015 assessment, which revealed it had likely been in the critical zone since around 2011.

Given the earlier concerns about the stock, it is likely that work to develop management measures to mitigate declines in the stock were initiated in advance of it officially being declared in the critical zone. Four of the other stocks included in rebuilding plans, and many of the currently depleted stocks without rebuilding plans, have also been below their LRPs for several years (Table 2), and DFO has presumably made some efforts to mitigate their decline. However, there has been little action to develop formal rebuilding plans until recently, despite a policy requirement since 2009 (DFO 2009).

Northern shrimp – Shrimp Fishing Area 6: The other stock to be included in a rebuilding plan developed within the proposed 24-month timeline was northern shrimp in shrimp fishing area (SFA) 6. This plan was developed within approximately 21 months (Table 2). Although there is room for improvement with this rebuilding plan, the timeline for its development is encouraging, given the stock’s recent decline. Rebuilding plan development for this stock was initiated by at least the 2017/18 fiscal year (DFO 2017a), likely related to the results of the February 2017 assessment that indicated the stock had just declined into the critical zone (DFO 2017b). The stock was included in a rebuilding plan published in November 2018 (DFO 2018c).

DRAFT REQUIREMENTS FOR REBUILDING PLANS

The draft regulations include five requirements for rebuilding plans developed based on existing guidelines (DFO 2018b, DFO 2013), each of which will be discussed in detail below.

1) A description of the stock status, stock trends and reasons for the stock’s decline

To better inform rebuilding efforts, it is important to understand the current situation facing a depleted stock, the factors that have contributed to the stock decline and factors that could impede rebuilding. This analysis should include a comprehensive review of: historic and current ecological, economic and social conditions; a history of the stock status and fishing pressure; status of and changes to key habitats; previous and expected interactions with other species or fishing fleets; vulnerability to climate change; life history traits and recent evolutionary changes; and key uncertainties (OCED 2012, Garcia et al. 2018). The current DFO rebuilding plan guidelines contain a template for rebuilding plans that includes two sections containing similar information relevant to this draft requirement (DFO 2013):

- i. Stock status: In this section, the guidelines indicate a summary of the stock status should be provided. It should include an overview of the Precautionary Approach (PA) framework in place for the stock, a summary of the most recent assessment and stock status, future stock prospects (i.e., trends), an overview of Aboriginal Traditional Knowledge/Traditional Ecological Knowledge,

stakeholder perspectives and a summary of any Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessments.

- ii. Management issues: In this section the guidelines indicate a summary of the factors that have led to the decline and factors that may influence rebuilding should be provided. It should include information on both directed fishing and bycatch, other non-fishing human-related factors, natural mortality, predator/prey interactions, environmental impacts, habitat limitations and the impacts of rebuilding the stock will have on other stocks/species.

All but one of the seven currently available rebuilding plans provide at least a brief description of the stock status, and most provide at least some information on recent stock trends and reasons for the stock decline (DFO 2018c, 2019b, 2019c, 2019d, 2019e). However, none provide the detail suggested in the current rebuilding plan guidelines, and few provide sufficient history to fully understand past decisions and circumstances that would help to identify lessons learned. For example, the three rockfish rebuilding plans provide the current status but very few details on the history of the assessment process or stock trends. The management sections are also primarily focused on current issues, lacking the historical context required to identify lessons learned. The other four rebuilding plans do a better job of discussing in more detail factors that led to stock declines and that could impact rebuilding. However, the management issues sections in these plans could still be improved with further details. See Box 2 for more details on how well current plans meet this proposed requirement.

A description of the stock status, stock trends and reasons for the stock's decline could be improved in all rebuilding plans by providing more detail and having an additional section dedicated to a review of impediments to successfully rebuilding the stock. This section should include information like that outlined in the section on management issues in the current rebuilding plan guidelines (see above). The section should also include considerations of the biology of the species, any recent evolutionary changes, vulnerability to climate change, and levels of uncertainty and risk. Furthermore, the importance of including an overview of all contributions to fishing mortality should be emphasized, with details on contributions from all known *and suspected* sources (including all directed commercial fisheries, incidental catches in other fisheries, recreational fisheries, bait fisheries and food, social and ceremonial fisheries).

Box 2: Adequacy of current rebuilding plan descriptions of the stock status, stock trends, and reasons for the stock's decline

Rockfish: The rockfish rebuilding plan, which includes three rockfish stocks in the Pacific Region, has a section pertaining to stock status for each stock where it simply states the status relative to the biomass at maximum sustainable yield (MSY) and the probability that it is below the LRP. It does not provide an overview of the assessment processes, types of data used or frequency of assessments. This multi-stock rebuilding plan does not provide details on recent stock trends or much detail on the prospects for any of the stocks included. It does have a management issues section containing limited information of the type suggested by the guidelines but is largely restricted to a brief list of current issues that may impact rebuilding with limited to no detail on them or factors that led to stock declines.

Northern shrimp: The rebuilding plan for this stock does not directly include information on stock status, trends or prospects, nor does it directly provide an overview of sources of fishing mortality. It does direct the reader to the Integrated Fishery Management Plan (IFMP), where brief information on these topics can be found. Although all plans refer to the IFMP for further details in various sections, the IFMPs often cover more than the stock of interest and the referenced sections usually do not provide the stock-specific details required. The management issues section of this plan does provide relevant information on factors believed to have led to the stock decline and factors that could influence rebuilding but is brief and lacking details on all factors. For example, commercial fishing is noted as one of three factors associated with the shrimp decline but is not discussed further, while environmental forcing and increases in predatory fishes are discussed in more detail.

Atlantic cod – Scotian shelf/Bay of Fundy: The rebuilding plan for this stock was unable to provide recent status relative to the LRP since it was developed without a recent assessment (which has since occurred, and the plan is under revision). It does provide detailed summaries of the most recent assessments, including figures with trends and discussion of past projections. The management issues section of the plan does a good job discussing recent issues in the mixed-groundfish fishery but does not discuss bycatch of cod in non-groundfish fisheries in detail, although it is identified later in the plan as a potential concern. The plan also does not adequately discuss past management efforts, such as a previous three-year rebuilding strategy implemented in the early 2000s (DFO 2000). Although the overview of fisheries in the rebuilding plan for Atlantic cod in 4X5Y could be improved, this plan, like the other two rebuilding plans developed in the DFO Maritimes Region, includes the most details on recent stock assessment history compared to other available plans and highlights recent management issues and strategies.

Atlantic cod – Georges Bank: The rebuilding plan for this stock provides a decent overview of the current assessment process, which is unique to three transboundary groundfish stocks on Georges Bank. The stock status section does provide a summary of the status (although not relative to the LRP) and the most recent assessment, including figures with trends. The management issues section of this plan identifies factors that may impede rebuilding, but it lacks details, provides little historical context and does not discuss factors that have led to the decline.

Yellowtail flounder – Georges Bank: The rebuilding plan for this stock also provides a decent overview of the current assessment process and includes figures with trends indicating status but is unable to provide status relative to the LRP, since the stock lacks reference points. The management issues section of this plan is largely focused on the last two years and lacks important historical context, such as previous rebuilding from a collapsed state (Stone et al. 2004) and details of the U.S. rebuilding plan in place for this transboundary stock since at least 2008. The management issues section does not discuss factors that may have led to the decline or that may impede rebuilding.

2) Measurable objectives aimed at rebuilding the stock with timelines for achieving the objectives. The objectives should identify the desired rebuilt state or target. For example, this could be aiming to achieve a stock status that is above the stock's limit reference point, within a given probability of success.

Clear objectives with associated timelines are essential to guide the rebuilding process and direct the development of specific rebuilding measures (DFO 2013, Garcia et al. 2018, OECD 2012). It is important that rebuilding objectives are measurable, to enable evaluation of progress towards them and assess whether they have been met. Objectives should be easily translated into indicators of change, and interim milestones or targets should be developed to better monitor the rebuilding process (Garcia et al. 2018). There are numerous types of objectives that should be considered related to social, economic, ecological and conservation aspirations. Often these interrelated objectives of varying types conflict, necessitating trade-offs (Garcia et al. 2018). However, given that socio-economic objectives are difficult to achieve without the stock being within biologically sustainable levels, achieving the target abundance will in most cases be a prerequisite for meeting socio-economic objectives (OECD 2012).

For harvested species, international law requires stocks be managed so the biomass that sustains MSY is achieved (Garcia et al. 2018). Most importantly, rebuilding should be about more than just biomass and yield: it should also be about restoring a fully functioning stock. A single exceptional year-class could be enough to produce an increase in biomass such that it surpasses targets (e.g., deepwater redfish in Units 1 and 2; DFO 2018d), but without a complete recovery of population traits (e.g., age-structure, sub-populations, age at maturity, geographical range), rebuilding might be incomplete and short-lived (Garcia et al. 2018). It is important that other non-biomass-related stock-specific objectives be developed and included in rebuilding plans.

Abundance objectives: The main target abundance objective of all currently available rebuilding plans (DFO 2018c, 2019b, 2019c, 2019d, 2019e) is rebuilding to a level above the LRP (equivalent to 40 per cent of the biomass that supports MSY), but they all also include the long-term objective of continuing rebuilding into the healthy zone (i.e., above the Upper Stock Reference point, or USR, equivalent to 80 per cent of the biomass that supports MSY). However, rebuilding plans are not intended to achieve the latter objective. Instead, this falls under the responsibility of Integrated Fisheries Management Plans (IFMPs). The rebuilding plan for northern shrimp in SFA 6, while stating these objectives, also clearly indicates the objectives are not yet implemented. While the rebuilding plan for yellowtail flounder on Georges Bank includes these objectives, it also indicates the stock does not have reference points (i.e., there is no LRP or USR defined).

Rebuilding plans should include a target abundance in the healthy zone, as required by international law, and be in place until the stock surpasses it (Elmslie 2019). In current policy (and possibly soon in regulations), a default target for rebuilding plans is to rebuild just above the LRP — in other words, just above the point where serious harm is occurring to the stock. Once this is achieved, a separate plan and process is implemented for continued growth into the healthy zone. This approach implies that the LRP is the finish line where we can declare stocks rebuilt and return to status quo management and fishing practices, even while stocks are in the cautious zone. This leaves our management system dangerously open to “sustainable overfishing” and complacency regarding stocks in the cautious zone. This is reinforced by policy that only requires rebuilding plans for stocks in the critical zone, despite the same policy also indicating rebuilding plans should be developed when stocks are declining in the cautious zone, so they are in place before a stock reaches the critical zone. When rebuilding to healthy is not attainable within a reasonable timeline and with high certainty (e.g., Atlantic cod in the Southern Gulf of St. Lawrence; Neuenhoff et al. 2019), then an exception to set a lower target, still above the LRP, could be allowed if the science-based rationale for setting the lower target is published.

Other rebuilding objectives: Rebuilding is about more than abundance: it should also be about restoring a fully functioning stock. Furthermore, there are likely to be desirable socio-economic objectives associated with rebuilding a stock and its fisheries. Six of the seven currently available rebuilding plans have some form of other objective(s) related to the biological characteristics of the stock, socio-economic

importance or cultural importance. These could be improved upon by adding more, clearly addressing trade-offs between the objectives, and ensuring they are stock-specific (DFO 2019b, DFO 2019c, DFO 2019d, DFO 2019e).

The rebuilding plan for three rockfish stocks in the Pacific indicates, as part of the abundance-related objectives, that for all three stocks the intent is to achieve rebuilding throughout the entire stock areas. Similarly, the rebuilding plans developed in the DFO Maritimes Region (for Atlantic cod in 4X5Y and Atlantic cod and yellowtail flounder in 5Z) include a component related to socio-economic and cultural values in their long-term abundance objective that aims to eventually “... *achieve and maintain the Spawning Stock Biomass in the Healthy Zone (i.e., at or above the USR) for the benefit of all Canadians, including harvesters, industry and the coastal communities which depend on the resource for their livelihood, and to provide reasonable fishing opportunities during the rebuilding period.*”² All six of these plans also include an overview of the overarching objectives of their respective multi-species groundfish IFMPs, which are broader but not stock-specific.

The rebuilding plan for northern shrimp in SFA 6 (DFO 2018c) does not have any stock-specific objectives related to the biological characteristics of the stock, socio-economic importance or cultural importance. From a biological perspective, this is particularly concerning considering the importance of shrimp as a food for other species (i.e., the role of shrimp as a forage species). Objectives related to the role of shrimp in the ecosystem should be developed. This plan, and the three developed in the DFO Maritimes Region (for Atlantic cod in 4X5Y and Atlantic cod and yellowtail flounder in 5Z), do however include stock-specific objectives pertaining to harvest levels or fishing mortality,³ while the rebuilding plan for northern shrimp SFA 6 also includes objectives related to assessment model formulation and rebuilding plan review.

Milestones: Milestones are specific and measurable interim targets that represent the steps towards rebuilding. Milestones can help better monitor the rebuilding trajectory and can be a valuable tool towards achieving abundance objectives if they can be expected to be achieved over a relatively shorter timeframe (Garcia et al. 2018, DFO 2013).

Four out of seven currently available rebuilding plans (DFO 2018c, 2019b, 2019c, 2019d, 2019e) include milestones associated with objectives, the majority of which are specific and measurable. The rebuilding plan for three rockfish stocks in the Pacific includes milestones for objectives associated with all three stocks. Generally, these pertain to achieving a positive stock trajectory trend in 5- or 10-year time periods en route to the target abundance. These could be improved by clearly indicating when each time period begins, but they are specific and measurable interim targets that represent steps towards the abundance target. The rebuilding plan for northern shrimp in SFA 6 includes milestones associated with nearly all objectives, the majority of which are specific, measurable and appropriate. Milestones associated with the long-term abundance objective of this plan are related to stabilizing the stock decline and achieving a positive stock trajectory. There are no milestones outlined in the rebuilding plan for Atlantic cod in 4X5Y or 5Z or yellowtail flounder in 5Z.

Timelines for achieving objectives: Timelines for achieving objectives, particularly the primary target abundance or biomass objective, are important to define at the outset of a rebuilding process (Garcia et al. 2018, OECD 2012). Clearly defining the timelines to achieve targets, and the reasons for the chosen timeframes, will ensure greater transparency in the process and ensure everyone has the same expectations. Given rebuilding often involves short-term costs to obtain long-term benefits, defining the timelines often requires trade-offs among the levels of restrictions and the time required for rebuilding (Garcia et al. 2018, OECD 2012). The rebuilding timeline will also depend on the characteristics of the stock (e.g., growth, age at maturity, reproduction), the depth of depletion, fishing pressure during

² This statement is from the rebuilding plan for Atlantic cod in 4X5Y and is nearly identical to a statement in the rebuilding plan for Atlantic cod in 5Z and yellowtail flounder in 5Z, although the latter lacks the material in brackets referring to the USR.

³ Although it should be noted that for both Atlantic cod rebuilding plans, the short-term objective to maintain fishing mortality below the fishing mortality limit for the critical zone cannot be evaluated because: 1) for Atlantic cod in 4X5Y, there is no longer a fishing mortality limit defined, and 2) for Atlantic cod in 5Z, there is no accepted modelling framework to estimate fishing mortality.

depletion, and environmental conditions, which can facilitate or impede rebuilding (Garcia et al. 2018). Rebuilding timeframes can be estimated from stock assessment models and/or harvest simulation testing and used to inform the choice of timelines, with some jurisdictions also imposing maximum timelines (e.g. 10 years in the U.S.A.; Garcia et al. 2018).

All rebuilding plans currently available (DFO 2018c, 2019b, 2019c, 2019d, 2019e) include timelines associated with rebuilding to a level above the LRP. But, only in the rebuilding plan for three rockfish stocks in the Pacific do timelines appear to be based on scientific estimates of how long rebuilding might take. Even in this plan, it is unclear if these are in fact based on a scientific estimate, as the details and source of the timelines are not included. Additionally, because of this lack of clarity, it is difficult to determine what year is the first year of the timelines. For example, the timeline for the yelloweye rockfish inside population was first included in the rebuilding plan published in 2018 (DFO 2018e) and appears to be based on the last biomass estimate for 2009 and associated projections (DFO 2011), meaning we were already nine years into the timeline at the time of rebuilding plan publication. Further, in the 2019 update of this plan (DFO 2019b), there is no indication that we are a year further into the timeline.

Two of the other rebuilding plans (northern shrimp in SFA 6 and Atlantic cod in 4X5Y) were developed without recent assessments and thus do not include timelines based on scientific estimates. While the other two rebuilding plans (Atlantic cod and yellowtail flounder in 5Z) were informed by recent assessments, neither includes a timeline informed by projections of how long rebuilding might take. For yellowtail flounder in 5Z, this is likely due in part to there being no accepted analytical model for the stock and the current empirical approach to assessment (TRAC 2018a). For Atlantic cod in 5Z, the lack of science-based timelines is likely due in part to the lack of confidence in the analytical model in the assessment conducted prior to the rebuilding plan, which was deemed unreliable (TRAC 2018b) and has since been abandoned. The three rebuilding plans for groundfish developed by the DFO Maritimes Region all indicate the general aspiration from the departmental rebuilding plan guidelines of rebuilding within a reasonable timeline (1.5–2 generations), which is identified in years for each species. The rebuilding plan for northern shrimp in SFA 6 indicates the intention to develop timelines for abundance targets in the third year of the plan, if an acceptable assessment model is in place.

Although scientists can be reluctant to make long-term projections given increased uncertainty beyond the year-classes currently observed, without them managers have little information available to inform realistic expectations (Shelton et al. 2007). All rebuilding plans should be developed with the support of recent scientific stock assessments that include projections estimating how long rebuilding might take. This should be used to inform a maximum bounded timeline for reaching abundance targets, ensuring that everyone has similar expectations, and is required to ensure that management measures are on track, as evaluated through performance reviews.

Rebuilt target with a given probability: Including acceptable probability levels for biomass point estimates or other aspects of rebuilding plans, such as harvest level decisions or rebuilding timelines, is one way to incorporate uncertainty and risk. There are unavoidable uncertainties and risks associated with rebuilding, including those related to the biology of the stock, trophic interactions, impacts of environmental conditions, stock assessment modelling and the effectiveness of potential rebuilding measures (DFO 2013). Uncertainty and risk should explicitly be considered in the development of rebuilding plans. Since stocks requiring rebuilding are vulnerable and there is little room for error, uncertainty and risk likely affect rebuilding more than normal management (Garcia et al. 2018, OECD 2012). The current DFO rebuilding plan guidelines discuss the importance of assessing uncertainty and risk and communicating it clearly (DFO 2013). They also indicate that objectives should include an acceptable probability level for reaching the target within the specified timeframe and that rebuilding plans should aim to have a high probability of the stock growing out of the critical zone within a reasonable timeframe. The draft regulation rebuilding plan requirement discussed above indicates rebuilding plan objectives should identify a desired rebuilt state or target, such as a stock status that is above the stocks LRP *with a given probability* (DFO 2018b).

All rebuilding plans currently available (DFO 2018c, 2019b, 2019c, 2019d, 2019e) include statements about acceptable probability levels to address uncertainties but vary in what the probability level addresses. Only the rebuilding plan for northern shrimp in SFA 6 clearly indicates the intention of having a probability associated with the biomass point estimate relative to the LRP, stating with the first long-term objective⁴ “*Stock biomass above the LRP (with 75% probability) ...*”. This plan also includes a probability that could be interpreted for use in decision making, stating that there be a *high probability* of success associated with the first short-term objective of ensuring harvest levels are consistent with the precautionary approach (PA) for SFA 6. This statement could imply, but does not explicitly state, that decisions on harvest level must have a high probability (i.e., 75–95 per cent) of not exceeding established exploitation rates for the given stock status zone it occupies.

The rebuilding plans for Atlantic cod in 4X5Y and 5Z similarly include harvest strategies that indicate while those stocks are in the critical zone, the quotas are to be set with a very low (less than five per cent) risk of preventable decline. These plans, like the other developed in the DFO Maritimes Region (for yellowtail flounder in 5Z), also indicate the general aspiration from the departmental rebuilding plan guidelines that rebuilding to a level above the LRP should be achieved in a reasonable timeframe (one to two generations) with a high degree of probability (greater than 75 per cent). It is unclear if this probability refers to the point estimate relative to the LRP or to meeting objectives within the timeframe (i.e., probability of success for the chosen strategy).

The rebuilding plan for three rockfish stocks in the Pacific is the only rebuilding plan to include probability estimates for rebuilding to abundance targets that appear to be based on scientific estimates of how long rebuilding will take under the chosen strategy (constant harvest levels). However, these are all lower than the 75 per cent implied by the DFO guidelines⁵ (65 per cent for bocaccio; 57 per cent for yelloweye rockfish – outside population; and 56 per cent for yelloweye rockfish – inside population). The plan provides no indications why alternative scenarios with higher probabilities of success were not chosen, when at times they appear to have been estimated (DFO 2011, DFO 2012, DFO 2015).

Uncertainty and risk must be incorporated in rebuilding plan development. Requiring that the stock status be above the target with a given probability is an appropriate means to ensure some aspects of uncertainty are incorporated. However, this could be improved by stating the acceptable probability level in regulation (i.e., 75–95 per cent). Acceptable probability levels should also be incorporated into harvest level decision making or harvest control rules, such that management measures result in a high (75–95 per cent) probability of rebuilding above targets, or of high probability (75–95 per cent) of not hastening decline when stocks are projected to decline even without fishing. Further, rebuilding plans should contain sections dedicated to uncertainty and risk, like those already included in many stock assessment reports. According to Garcia et al. (2018), rebuilding plans robust to uncertainty require: (i) good risk awareness, (ii) effective monitoring and assessment, (iii) reactive management and communication, and (iv) capacity to make decisions under uncertainty and react in case of unexpected events.

3) Management measures aimed at achieving the objectives

Rebuilding fisheries usually requires concurrent use of multiple management measures (Garcia et al. 2018, OCED 2012). Current DFO rebuilding guidelines require a section dedicated to the management measures necessary to meet objectives, which could include: catch reductions or controls, gear modifications or restrictions, closed areas, habitat protection and restoration measures, monitoring, and harvest decision or control rules (DFO 2013).

International best practices further emphasize the importance of pre-agreed harvest decision or control rules, specifying pre-determined management measures (i.e., harvest level) in relation to the difference between the current stock size/structure and rebuilding targets (Garcia et al. 2018, OCED 2012). They also identify management strategy evaluation (MSE) as the best practice to develop management measures, particularly harvest control rules. MSE is a method used to identify and compare different

⁴ Note, the rebuilding plan clearly states long-term objectives are not yet implemented.

⁵ According to risk tolerances for decline included in the PA framework (DFO 2009), “high” could be interpreted to imply 75 to 95%.

management strategies to determine how robust they are to errors in measurement, errors in assessment modelling, and other known or suspected sources of uncertainty while balancing multiple social, economic or biological objectives. When conducted with rights-holders and stakeholders, MSE can help foster collaboration and cooperation in the rebuilding process and enhance buy-in, but it can be resource intensive for everyone involved, and scientific and management expertise for using it is limited, although growing (Garcia et al. 2018).

In Canada, all currently available rebuilding plans contain sections dedicated to management measures but vary in the level of the detail included and provide little evidence that the selected measures will promote rebuilding. None include stock-specific harvest decision or control rules developed specifically to promote rebuilding and outlining how the stock will be fished throughout the rebuilding period.

Rebuilding plans should include a compilation of all management measures in place pertaining to the stock, in both directed fisheries and fisheries that interact with the stock as bycatch. For example, the rebuilding plan for Atlantic cod in 4X5Y does not indicate if cod caught as bycatch in the lobster fishery can be retained or not, despite indicating bycatch of cod in this fishery is of potential concern. Currently, there is no single source compiling in detail all management measures that apply to a depleted stock. IFMPs contain some management measures but are often not specific to the stock of interest (e.g., multiple stocks of the same or different species are included), often lack specific details, and only provide information for either the targeted fishery or the fishery that interacts with the stock as bycatch, but not both. Other more specific measures are included in fleet-specific Conservation Harvesting Plans, while more measures are in place in licence conditions and regional fisheries regulations. Without a central location detailing all measures in place across fisheries interacting with the stock, it is difficult to truly evaluate how well they are contributing (or are expected to contribute) to meeting rebuilding plan objectives. A detailed evaluation of all current management measures should be included in rebuilding plans. This should also include detailed information on catch monitoring tools and levels, as well as recommendations for improving catch monitoring in fisheries interacting with the stock.

Rebuilding plans should include extra measures beyond what is conducted under regular management (i.e., IFMPs) for a given stock. There has been a disturbing trend in recently developed rebuilding plans: not including any new management measures to promote rebuilding or evidence that existing measures are working (see Box 3 for details). According to the current DFO rebuilding plan guidelines (DFO 2013), rebuilding plans are an extension of the IFMP and should outline the specific objectives, timelines and management measures required to grow the stock above the LRP, reflecting the unique requirements for rebuilding. This implies that for stocks in the critical zone, newly developed rebuilding plans will include content over and above that already included in IFMPs. Furthermore, the guidelines indicate that pre-agreed harvest control rules are an essential component of any management plan, including rebuilding plans (DFO 2013).

The current DFO rebuilding plan guidelines and the PA framework (DFO 2009) indicate the following guidance for the development of harvest control rules for stocks in the critical zone: *“conservation considerations should prevail; management actions cannot be inconsistent with secure recovery; harvest rates, taking into account all sources of removals, should be kept to an absolute minimum until the stock has cleared the critical zone; and management actions must promote stock growth”* (DFO 2013). All rebuilding plans should contain stock-specific harvest control rules that address *all sources* of fishing mortality, and these rules should be adhered to when making harvest level decisions. MSE should be used periodically as a tool to aid in their design and assess their effectiveness.

Box 3: Lack of new management measures or evidence existing measures adequately promote rebuilding

The yelloweye rockfish inside population management measures highlight a disturbing trend in recently developed rebuilding plans: not including any new management measures to promote rebuilding or evidence existing measures are working. This stock was added to the Pacific Region's multi-species groundfish rebuilding plan in 2018, yet the main management measure discussed is the 2012 intention to restrict total mortality to 15 tonnes across all sectors. It is difficult to determine whether this measure is appropriate because there is no accompanying rationale for its implementation in 2012 and no sources cited to provide evidence of why the department believed this would promote rebuilding when implemented or when the rebuilding plan was completed in 2018. Furthermore, there was no evaluation of its achievement (i.e., what the realized estimated total mortality was in the years following) and its effectiveness in promoting rebuilding since 2012. Mortality caps are also the main measures discussed for the other two rockfish stocks previously included in this annually updated multi-species rebuilding plan (bocaccio rockfish was included in 2014 and yelloweye rockfish outside population in 2016). The management measure sections of this plan could be improved by clearly reporting on the rationale for the mortality cap choice and updating progress towards their achievement (and explaining why TAC still appears to be set above mortality cap targets for bocaccio).

The rebuilding plan for northern shrimp in SFA 6 also contains no new management measures, instead largely referring to the IFMP for details on management. To gauge what measures are currently in place, one must wade through information for all areas of the entire northern shrimp fishery and determine if they are applicable to SFA 6 or not. This plan does indicate that the current PA framework and associated harvest strategy apply, appropriately providing explicit guidance for harvest level decisions (DFO 2018c). They have been in use for SFA 4 to 6 and the Eastern Assessment Zone since 2010. However, it should be noted that during the January 2017 Science process evaluating reference points, the validity of the current PA exploitation rates outlined for each of the health status zones for this stock were questioned, and it was pointed out that the current LRP and critical zone exploitation rate is not consistent with the DFO PA framework (DFO 2017c). Surprisingly, this is not discussed in the rebuilding plan.

The rebuilding plans developed for Atlantic cod in 4X5Y and 5Z also do not include any new management measures beyond those already included in the IFMP pertaining to the stocks. They do include harvest strategies and tactics previously developed for the stock and found in the IFMP. For the most part, these are the same as the tactics for the generic harvest strategy used for all groundfish in the region (DFO 2018e). While helpful to guide decision making, these strategies should be augmented with stock-specific harvest decision rules that clearly outline how each stock will be harvested during the rebuilding period, along with the evidence indicating why it is believed the rules will promote rebuilding.

The rebuilding plan for yellowtail flounder in 5Z also does not include any new management measures beyond those in the IFMP. However, this plan does outline a new harvest strategy indicating the intention that Canada will keep the exploitation rate of the Canadian portion of the fishery as low as possible and below an upper bound of six per cent. It is appropriate to include a new harvest strategy consistent with the empirical approach used for the stock, given the previous strategy relying on modelled fishing mortality has been unusable since 2014. However, there are two concerning aspects to this strategy. First, this wording does not necessarily mean quotas will be set (even the Canadian portion) below an upper bound of six per cent, which was what the science advice for this upper bound was purposefully based on (TRAC 2018a), and instead implies DFO will keep realized catch below six per cent. And secondly, the science-advised upper bound of six per cent was for combined U.S. and Canadian quotas, not just Canadian. With this strategy there is a risk the quota will be set above the levels advised by science, and even though quotas have not been reached recently, means the department is risking that it could be caught and be allowable.

Despite these issues, these latter three rebuilding plans do provide the best overviews of existing recent and current management measures for fisheries permitted to land the stocks (and for the Georges Bank stocks, also the scallop fishery interacting with the stocks), discussing relevant knowledge gaps and uncertainties, and suggesting potential improvements to consider in the future. These plans could be improved by including the rationale for the selection of management measures chosen, with any evidence indicting why they are believed to promote rebuilding.

4) A method to track progress to achieve the rebuilding plan's objectives

Tracking progress or conducting performance assessments on a regular basis is an integral component of rebuilding fisheries, and results should be reported publicly (Garcia et al. 2018, OCED 2012, DFO 2013). Performance assessments are very much dependent upon the quality of the plan and the clarity of its objectives and targets (e.g., are they measurable?), as well as the quality of monitoring and institutional capacity to gather and analyse the information required (Garcia et al. 2018). Constant monitoring and frequent assessments are essential to identify success or failure, avoid surprises and enable adaptive management, but they should be robust to normal variability and uncertainty and the risk of over-reacting by confusing stock signals with ambient “noise” (Garcia et al. 2018).

The current DFO rebuilding guidelines differentiate between two types of review or monitoring: 1) performance review of criteria clearly outlined in the rebuilding plan and explicitly linked to the objectives and associated milestones, as well as management measures, and 2) regular continuous monitoring that examines ongoing changes in stock status, resulting in implementation of associated harvest decision rules (DFO 2013). The guidelines indicate each rebuilding plan should include a section on performance reviews, outlining indicators specifically developed for the plan that will be used to determine if the rebuilding plan objectives are being met. Timelines for performance review should also be provided and results included as an appendix to the plan (DFO 2013).

All currently available rebuilding plans contain sections dedicated to evaluation and performance review but vary greatly in details provided, and all could be improved by clearly indicating when and how progress towards rebuilding objectives will be reviewed. The rebuilding plan for three rockfish stocks in the Pacific does the best job of establishing a plan for monitoring, review, evaluation and revision of management measures. It indicates an adaptive management approach will be used, acknowledging the need to monitor progress towards objectives and milestones and adapt management where needed. The plan highlights what content will be reviewed in an annual review process and indicates the advisory body that would be consulted on any new measures. But, despite this multi-stock plan being in place for several years, there is no reporting on the results of these annual reviews. All other rebuilding plans indicate the advisory body responsible for monitoring the plan and include some indication as to the frequency of reviews (annually⁶ or as needed after the next assessment⁷), but all fail to indicate exactly how progress towards objectives will be tracked. All rebuilding plans should clearly outline the indicators that will be used to determine if the rebuilding plan objectives are being met, how frequently reviews will occur and who will conduct them, and the results of the reviews as appendices to the rebuilding plan document as completed.

The rebuilding plans developed for three groundfish stocks by the DFO Maritimes Region all include the term “enhancement” in the title of the evaluation and performance review section. This section in these plans contains content that clearly identifies knowledge gaps and future management considerations that address known or suspected issues in relation to the rebuilding of each stock. Importantly, these sections clearly outline these issues in a table of future action items to support rebuilding, with the issue, action, timeline for completion and responsible sectors identified. These tables outlining action items to promote rebuilding clearly indicate what needs to be addressed moving forward to help rebuild this stock. They provide guidance to DFO, rights-holders and stakeholders about what needs to be done, when, and by whom, as well as transparency for everyone about the next steps. The “enhancement” addition to this section is valuable and should be used as a model in other rebuilding plans, but it does not establish a clear plan for monitoring, reviewing, evaluating and revising the rebuilding plan.

5) An approach to review the objectives and adjust them if the objectives are not being achieved

⁶ The rebuilding plan for northern shrimp in SFA 6 indicates it will be reviewed annually

⁷ The rebuilding plans for Atlantic cod in 4X5Y and 5Z each indicate they will be reviewed as needed after the next stock assessments planned for 2019 and 2020, respectively, and the rebuilding plan for yellowtail flounder in 5Z indicates it will be reviewed each year following annual assessments.

In addition to near-continuous monitoring of progress towards objectives, it can be important to periodically conduct a thorough review of the entire rebuilding plan on a longer-term cycle (Garcia et al. 2018). But, clearly establishing the approach, mechanisms, pre-conditions and procedures for such review and potential revision should be clearly articulated, to avoid undue pressure to tinker with the plan (Garcia et al. 2018).

As noted above, all rebuilding plans contain sections dedicated to evaluation and performance review but vary greatly in the details provided, with none clearly indicating the process to review rebuilding objectives themselves. Currently developed rebuilding plans appear to mix annual monitoring activities, the review of progress towards objectives and targets and a review of the rebuilding plan itself and do not clearly differentiate between these activities nor detail exactly how most of them will be accomplished.

It is important to review not just progress but also the entire rebuilding plan and its associated objectives. However, care should be taken not to adjust objectives just because they are not being achieved. Certain target abundance objectives are required by international law (i.e., biomass that sustains MSY) or national policy (e.g., exceed the LRP) and must remain in place. However, a performance review of the entire plan, including the management measures in place, timelines (e.g., if environmental conditions have changed) and milestones towards objectives could occur and the plan revised as necessary to ensure rebuilding is being promoted. But the possible alterations to the rebuilding strategy and transparent criteria justifying them and the circumstances under which this could occur need to be clearly indicated beforehand in the rebuilding plan (Garcia et al. 2018).

OTHER IMPORTANT REBUILDING PLAN CONTENT

International guidelines and reviews of best practices for rebuilding fisheries (e.g., Garcia et al. 2018, OCED 2012) and the current DFO rebuilding guidelines (DFO 2013) include more best practices than those discussed above, many of which are included in the compilation of global best practices for rebuilding previously developed by Oceana Canada (2017). While many of these components of rebuilding plans may not be vital enough to be required by regulations, they are still important aspects that should be included in rebuilding plans to ensure the promotion of rebuilding. Below is an evaluation of how well currently available rebuilding plans meet these additional best practices not previously discussed above.

Develop and implement rebuilding plans in consultation with rights-holders and stakeholders

All parties directly affected by the rebuilding plan should be consulted and included in rebuilding plan development to ensure all relevant information is available for review and to enhance buy-in and compliance (Oceana Canada 2017, OCED 2012, Garcia et al. 2018).

The rebuilding plan for northern shrimp in SFA 6 is the only plan that clearly indicates the establishment of a formal working group dedicated to developing the rebuilding plan. The Rebuilding Plan Working Group for northern shrimp in SFA 6 consists of a subset of members of the Northern Shrimp Advisory Committee and is made up of stakeholders with interests in SFA 6 shrimp. The other rebuilding plans do not clearly state the process followed for their development, nor do they sufficiently outline any consultations that were conducted. The other plans appear to have been developed by management and then consulted on as part of the regular consultative process for the primary fisheries targeting each stock (i.e., industry-DFO advisory committees), based on the fact each plan indicates these committees will be involved in future reviews of the plans. Exactly how these plans were developed should be documented more clearly.

Further, although it is an efficient use of resources to use previously existing consultative bodies, involving only advisory committees with membership from commercial fisheries targeting (or previously targeting) the stock means other fisheries interacting with it as bycatch or for non-commercial purposes are not directly involved in developing the rebuilding plan. For example, it is suspected that a non-trivial amount of Atlantic cod in 4X5Y are caught as bycatch in overlapping lobster and scallop fisheries, and the rebuilding plan identifies the lobster fishing industry and the Full Bay inshore scallop fleet as responsible

sectors on action items to promote rebuilding. Yet, the rebuilding plan is not clear on whether the respective lobster and scallop advisory committees were consulted during the rebuilding plan development process. By only consulting the advisory committee for the targeted commercial fishery, the scope of discussion during rebuilding plan development is limited to measures pertaining to it.

Formal dedicated working groups should be formed for the development of all rebuilding plans and include membership from all rights-holders and stakeholders interacting with the stock. This is especially important considering rebuilding plans should be developed under an ecosystem-based approach. This means considering other fisheries interacting with the stock as bycatch, trophic dynamics and environmental change. It also means considering the indirect effects of concurrent fisheries management of *other species* that interact with the stock in the ecosystem. This may require developing a larger bioregional approach to fisheries management that brings together single-species rebuilding and integrated fisheries management plans into integrated oceans management approaches.

Be publicly available

Rebuilding plans and results of reviews should be publicly available to increase transparency of decision making and ensure everyone has access to the information required to evaluate the plan (Oceana Canada 2017, OCED 2012, Garcia et al. 2018).

The three rebuilding plans developed for groundfish stocks by the DFO Maritimes Region are the only plans easily found online on the DFO website with stand-alone hyperlinks appearing alongside the IFMP hyperlink. The rebuilding plan for northern shrimp in SFA 6 is available online but requires navigating the IFMP website and finding it by scrolling through the appendices. The rebuilding plan for three rockfish stocks in the Pacific is not readily available on the DFO website. The plan is published as an appendix to the complete Pacific groundfish IFMP, which is available upon request. A summary of the IFMP is available on the website. The full IFMP and associated rebuilding plan is available to the public via a search of the Federal Science Library.

Provide an overview of economic, social and ecological impacts of the rebuilding plan

Given that rebuilding can involve short-term social or economic costs to obtain long-term benefits and that there can be ecological impacts associated with rebuilding a stock (e.g., due to trophic interactions), it is important to clearly discuss and evaluate the impacts of the intended rebuilding trajectory (Oceana Canada 2017, OCED 2012, Garcia et al. 2018). This will reduce surprises and allow for mitigation planning.

None of the rebuilding plans published to date provide a comprehensive overview of the economic, social and ecological impacts of rebuilding. Two plans (northern shrimp in SFA 6 and the rebuilding plan for three rockfish stocks in the Pacific) contain a section titled "Cost Benefit Analysis," which briefly discusses socio-economic impacts in a qualitative manner but falls far short of a quantitative analysis of short- and long-term costs and benefits, as suggested in the current DFO rebuilding plan guidelines (DFO 2013). The rebuilding plan for northern shrimp in SFA 6 does briefly discuss ecological impacts of rebuilding shrimp on other species but could be improved with further details and references for further information.

Provide an outline of the steps to follow when objectives are met

An important part of developing rebuilding plans is to decide how a fishery will be managed after it is rebuilt, and how fishing effort will be increased, if at all (Oceana Canada 2017, OCED 2012, Garcia et al. 2018). This allows for planning and helps clarify who will benefit from the rebuilt stock. It should also help prevent backsliding or premature re-opening. This is facilitated by a clearly defined end point and re-opening protocol.

Other than stating that a different plan and process (i.e., IFMP) will be used once the LRP is exceeded, none of the rebuilding plans adequately outline the steps to follow when objectives are met, such as indicating what changes may be expected to management once the stock is rebuilt or to whom rebuilt

catches will be allocated. For example, the rebuilding plan for three rockfish stocks in the Pacific clearly states that once the primary objective of exceeding the LRP is met for each stock, the standard IFMP process will be used to support the longer-term objective of stock growth into the healthy zone. The rebuilding plans for two Atlantic cod stocks developed by the DFO Maritimes Region (in 4X5Y and 5Z) provides some guidance. Each of these plans includes a previously existing harvest strategy for setting the total allowable catch (TAC) in various scenarios of each health status zone, including the healthy zone. This strategy is identical to the generic harvest strategy for all groundfish in the multi-species groundfish IFMP for the region. These plans also include existing allocation shares for the groundfish fisheries. If one assumes these will be maintained once the stock is rebuilt, then some guidance is provided. The rebuilding plan for yellowtail flounder on Georges Bank (5Z) also includes a table summarizing the existing shares but lacks a harvest strategy for the other health status zones. The rebuilding plan for northern shrimp in SFA 6 does refer to the harvest strategy in the IFMP, which includes the healthy zone, but again is generic to multiple SFAs and not stock-specific. It does, however, importantly outline the next steps if an assessment model is developed and accepted (the second short-term objective), as well as the next steps if it is not accepted.

As noted above, the current approach in Canada of having two separate processes and plans for critical stocks versus cautious and healthy stocks implies that the LRP is the finish line where we can declare stocks rebuilt and return to status quo management and fisheries, even though the stock is in the cautious zone. This leaves our management system dangerously open to “sustainable overfishing” and complacency regarding stocks in the cautious zone. Rebuilding plans should include a target abundance in the healthy zone, as required by international law, and be in place until the stock surpasses it.

SUMMARY AND RECOMMENDATIONS

The draft rebuilding regulations and associated timelines for rebuilding plan development and implementation should be improved by providing more clarity on expectations, such as explicitly requiring a target abundance and timeframe for achieving it. Rebuilding plan guidelines should be updated to ensure the intentions of new regulations are clearly met. Currently available rebuilding plans are not adequately meeting proposed draft content, which itself is ambiguous. Although most current plans address the “scoping the situation” step in the development of a rebuilding strategy,⁸ they lack other key areas required to make them what they are supposed to be: transparent roadmaps to operationalize strategies that increase the probability of rebuilding the stock.

In order to ensure rebuilding plans that are developed moving forward meet global best practices, offer greater potential for our depleted fish stocks to rebuild and contribute to more resilient ecosystems, and provide long-term economic prosperity for our fishing communities, Oceana Canada recommends the following improvements:

Rebuilding plan development, targets and timelines:

1. Require a target abundance in the healthy zone. Where a target in the healthy zone is not attainable within a reasonable timeline, then an exception to set a shorter-term lower target could be allowed if the science-based rationale for setting the lower target is published.
2. Require that rebuilding plans be in place until the stock surpasses the target abundance with high probability, defined as at least 75 per cent, for at least three years in a row.
3. In addition to a target abundance objective, include other stock-specific biological or socio-economic objectives.
4. Ensure rebuilding plans are developed with the support of recent scientific stock assessments that include projections estimating how long rebuilding might take that are used to inform the choice of a maximum bounded timeline for reaching abundance targets.

⁸ In *sensu* “scoping the situation” step in Chapter 7 of Garcia et al. (2018).

Rebuilding plan content and management measures:

5. Ensure the description of the stock status, stock trends, and reasons for the stock's decline has detailed information on *all* sources of fishing mortality and includes enough detail to identify lessons learned. Add an additional section dedicated to a review of impediments to successfully rebuilding the stock.
6. Include in rebuilding plans a compilation of *all* management measures in place pertaining to the stock, in both directed fisheries and fisheries that interact with the stock as bycatch, with a detailed evaluation of how they are expected to promote rebuilding.
7. Develop and include in rebuilding plans extra management measures beyond what is conducted under regular management (i.e., IFMPs) for a given stock, and include rationale providing the evidence why selected measures are expected to promote rebuilding. Include in these measures stock-specific harvest control rules that address all sources of fishing mortality, and ensure these rules are adhered to when making harvest level decisions.
8. Provide a comprehensive overview of expected economic, social and ecological impacts of the chosen rebuilding trajectory and management measures.

Monitoring progress and rebuilding plan review:

9. Differentiate between annual monitoring activities, reviews of progress towards objectives and targets and reviews of the rebuilding plan itself. Clearly outline how and when the reviews will occur, who will conduct them and what indicators will be used to determine if the rebuilding plan objectives are being met.
10. Include the results of the reviews as publicly available appendices to the rebuilding plan document.

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 35. Yamanaka, K.L., & Lacko, L.C. (2004). Inshore Rockfish (*Sebastes ruberrimus*, *S. malliger*, *S. caurinus*, *S. melanops*, *S. nigrocinctus*, and *S. nebulosus*) Stock Assessment for the West Coast of Canada and Recommendations for Management. DFO Can. Sci. Advis. Sec. Res. Doc. 2001/139.
http://www.dfo-mpo.gc.ca/csas-sccs/publications/resdocs-docrech/2001/2001_139-eng.htm

Table 1. Seven stocks are currently included in active rebuilding plans published by DFO.

Species	Stock	Rebuilding plan
Bocaccio (<i>Sebastes paucispinis</i>)	British Columbia coastwide	Appendix 9: Rebuilding Plans for Groundfish Species. <i>In</i> Pacific Region Integrated Fisheries Management Plan, Groundfish, Effective February 21, 2019, Version 1.1. http://waves-vagues.dfo-mpo.gc.ca/Library/40765167.pdf
Yelloweye rockfish (<i>Sebastes ruberrimus</i>)	Pacific Marine Fisheries Commission major areas 3CD and 5ABCDE (outside population)	Appendix 9: Rebuilding Plans for Groundfish Species. <i>In</i> Pacific Region Integrated Fisheries Management Plan, Groundfish, Effective February 21, 2019, Version 1.1. http://waves-vagues.dfo-mpo.gc.ca/Library/40765167.pdf
Yelloweye rockfish (<i>Sebastes ruberrimus</i>)	Pacific Marine Fisheries Commission major area 4B ⁹ (inside population)	Appendix 9: Rebuilding Plans for Groundfish Species. <i>In</i> Pacific Region Integrated Fisheries Management Plan, Groundfish, Effective February 21, 2019, Version 1.1. http://waves-vagues.dfo-mpo.gc.ca/Library/40765167.pdf
Atlantic cod (<i>Gadus morhua</i>)	Northwest Atlantic Fisheries Organization (NAFO) area 4X5Y (Scotian shelf/Bay of Fundy)	Rebuilding Plan for Atlantic Cod – NAFO Division 4X5Y. http://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/cod-morue/cod-morue-2018-eng.html
Northern shrimp (<i>Pandalus borealis</i>)	Shrimp Fishing Area 6 (the southern coast of Labrador and northeastern coast of Newfoundland)	Annex J - Rebuilding Plan for Northern Shrimp SFA 6. <i>In</i> Integrated Fisheries Management Plan for Northern Shrimp and Striped Shrimp – Shrimp Fishing Areas 0, 1, 4–7, the Eastern and Western Assessment Zones and North Atlantic Fisheries Organization (NAFO) Division 3M. Effective 2018. http://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/shrimp-crevette/shrimp-crevette-2018-002-eng.html
Atlantic cod (<i>Gadus morhua</i>)	Northwest Atlantic Fisheries Organization (NAFO) area 5Z (Georges Bank)	Rebuilding Plan for Atlantic Cod – NAFO Division 5Z. http://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/cod-morue/cod-morue-2019-eng.html
Yellowtail flounder (<i>Limanda ferruginea</i>)	Northwest Atlantic Fisheries Organization (NAFO) area 5Z (Georges Bank)	Rebuilding Plan for Yellowtail Flounder – NAFO Division 5Z. http://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/flounder-limande/2018/index-eng.html

Table 2. A look at whether existing rebuilding plans (developed under current policy requirements) would have met DFO's proposed timelines to develop rebuilding plans under draft regulations, stated as: "A rebuilding plan for a prescribed stock must be put in place within 24 months after the minister has triggered Section 6.2(1). Section 6.2(1) is triggered when the minister determines that the listed stock has declined to or below its limit reference point. The 24-month timeline may be extended to 36 months for the following reasons: to collect and provide the scientific information necessary to develop a rebuilding plan, to provide additional time to seek feedback on the rebuilding plan from Indigenous peoples, to discuss with another jurisdiction(s) the management measures for a shared stock" (DFO 2018b).

Stock	Would the existing rebuilding plan have met the proposed timelines?	Details
Bocaccio	No	There were approximately 65 months between the time it was determined the stock was below the LRP and the rebuilding plan being publicly available. The rebuilding plan was published in February 2014. ¹⁰ The stock was first noted as being in the critical zone during a stock assessment meeting held in November 2008. ¹¹ Information provided at that meeting indicated that the stock had likely declined into the critical zone in the 1980s. Declines were noted at least as early as 2000. ¹² Information provided at that meeting indicated the stock was first assessed as "threatened" by the COSEWIC in 2002, ¹³ and management measures to mitigate decline were considered as early as 2004. ^{14,15} In May 2012, a stock assessment was conducted that appears to have been used to support development of the rebuilding plan. ¹⁶
Yelloweye rockfish – outside population	Yes	There were approximately five months between the time it was determined the stock was below the LRP and the rebuilding plan being publicly available. The rebuilding plan was published in February 2016. ¹⁷ The stock was first noted as being in the critical zone during a stock assessment meeting held in September 2015. ¹⁸ Information provided at that meeting indicated that the stock had likely declined into the critical zone around 2011. That assessment also appears to have been used to support the development of

⁹ Pacific Marine Fisheries Commission Major Area 4B encompasses the entire Inside population, but also includes at both extremes a small portion of the Outside population.

¹⁰ DFO (2014). Appendix 9: Rebuilding Plans for Groundfish Species. In Pacific Region Integrated Fisheries Management Plan, Groundfish, Effective February 21, 2014, Version 1.0. <http://waves-vagues.dfo-mpo.gc.ca/Library/365005.pdf>

¹¹ DFO (2009). Recovery Potential Assessment of Bocaccio in British Columbia Waters. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/040. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2009/2009_040-eng.htm

¹² Stanley, R.D., Rutherford, K. & Olsen, N. (2001). Preliminary Status Report on Bocaccio (*Sebastes paucispinis*). DFO Can. Sci. Advis. Sec. Res. Doc. 2001/148. http://www.dfo-mpo.gc.ca/csas-sccs/publications/resdocs-docrech/2001/2001_148-eng.htm

¹³ COSEWIC (2002). COSEWIC Assessment and Status Report on the Bocaccio (*Sebastes paucispinis*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 43 pp. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_bocaccio_e.pdf

¹⁴ DFO (2004). Allowable Harm Assessment for Bocaccio. DFO Can. Sci. Advis. Sec. Stock Status Report 2004/043. <https://waves-vagues.dfo-mpo.gc.ca/Library/316488.pdf>

¹⁵ Stanley, R.D., Starr, P., & Olsen, N. (2004). Bocaccio Update. DFO Can. Sci. Advis. Sec. Res. Doc. 2004/027. http://www.dfo-mpo.gc.ca/csas-sccs/publications/resdocs-docrech/2004/2004_027-eng.htm

¹⁶ DFO (2012). Stock Assessment Update for Bocaccio (*Sebastes paucispinis*) in British Columbia Waters for 2012. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/059. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2012/2012_059-eng.html

¹⁷ DFO (2016). Appendix 9: Rebuilding Plans for Groundfish Species. In Pacific Region Integrated Fisheries Management Plan, Groundfish, Effective February 21, 2016, Version 1.3. <http://waves-vagues.dfo-mpo.gc.ca/Library/361424.pdf>

¹⁸ DFO (2015). Stock Assessment for the Outside Population of Yelloweye Rockfish (*Sebastes ruberrimus*) for British Columbia, Canada in 2014. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/060. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2015/2015_060-eng.html

Stock	Would the existing rebuilding plan have met the proposed timelines?	Details
		<i>the rebuilding plan. Declines of yelloweye rockfish in B.C. were noted at least as early as 2001,¹⁹ with calls to rebuild. The stock was first assessed as “special concern” by COSEWIC in 2008.²⁰</i>
Yelloweye rockfish – inside population	No	There were approximately 82 months between the time it was determined the stock was below the LRP and the rebuilding plan being publicly available. The rebuilding plan was published in February 2018. ²¹ The stock was first noted as being in the critical zone during a stock assessment meeting held in April 2011. ²² Information provided at that meeting indicated that the stock had likely declined into the critical zone around 1997. That assessment also appears to have been used to support the development of the rebuilding plan. Declines of yelloweye rockfish in B.C. were noted at least as early as 2001, ²³ with calls to rebuild. The stock was first assessed as “special concern” by COSEWIC in 2008. ²⁴
Atlantic cod – 4X5Y	No	There were approximately 119 months between the time it was determined the stock was below the LRP and the rebuilding plan being publicly available. The rebuilding plan was published in January 2019. ²⁵ The stock was first noted as being in the critical zone during a stock assessment meeting held in February 2009. ²⁶ Information provided at that meeting indicated that the stock had likely declined into the critical zone around 1999. The rebuilding plan was developed without a recent assessment, largely relying on a recovery potential assessment conducted in 2011. ²⁷ However, the stock was assessed again in December 2018, ²⁸ and information from that assessment is being used to update the rebuilding plan. The stock was regularly assessed in the 1980s and 1990s and declines were noted prior to 2000, when a three-

¹⁹ Yamanaka, K.L., & Lacko, L.C. (2004). Inshore Rockfish (*Sebastes ruberrimus*, *S. malliger*, *S. caurinus*, *S. melanops*, *S. nigrocinctus*, and *S. nebulosus*) Stock Assessment for the West Coast of Canada and Recommendations for Management. DFO Can. Sci. Advis. Sec. Res. Doc. 2001/139. http://www.dfo-mpo.gc.ca/csas-sccs/publications/resdocs-docrech/2001/2001_139-eng.htm

²⁰ COSEWIC (2008). COSEWIC Assessment and Status Report on the Yelloweye Rockfish (*Sebastes ruberrimus*), Pacific Ocean Inside Waters Population and Pacific Ocean Outside Waters Population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 75 pp. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_yelloweye_rockfish_0809_e.pdf

²¹ DFO (2018). Appendix 9: Rebuilding Plans for Groundfish Species. In Pacific Region Integrated Fisheries Management Plan, Groundfish, Effective February 21, 2018, Version 1.01. <http://waves.vagues.dfo-mpo.gc.ca/Library/40657814.pdf>

²² DFO (2011). Stock Assessment for the Inside Population of Yelloweye Rockfish (*Sebastes ruberrimus*) In British Columbia, Canada for 2010. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/084. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2011/2011_084-eng.html

²³ Yamanaka, K.L., & Lacko, L.C. (2004). Inshore Rockfish (*Sebastes ruberrimus*, *S. malliger*, *S. caurinus*, *S. melanops*, *S. nigrocinctus*, and *S. nebulosus*) Stock Assessment for the West Coast of Canada and Recommendations for Management. DFO Can. Sci. Advis. Sec. Res. Doc. 2001/139. http://www.dfo-mpo.gc.ca/csas-sccs/publications/resdocs-docrech/2001/2001_139-eng.htm

²⁴ COSEWIC (2008). COSEWIC Assessment and Status Report on the Yelloweye Rockfish (*Sebastes ruberrimus*), Pacific Ocean Inside Waters Population and Pacific Ocean Outside Waters Population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 75 pp. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_yelloweye_rockfish_0809_e.pdf

²⁵ DFO (2019). Rebuilding Plan for Atlantic Cod - NAFO Division 4X5Y. <http://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/cod-morue/cod-morue-2018-eng.html>

²⁶ DFO (2009). Cod on the Southern Scotian Shelf and in the Bay of Fundy (Div. 4X/5Y). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/015. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2009/2009_015-eng.htm

²⁷ DFO (2011). Recovery Potential Assessment (RPA) for the Southern Designatable Unit (NAFO Divs. 4X5Yb and 5Zjm) of Atlantic Cod (*Gadus morhua*). DFO Can. Sci. Advis. Sec. Advis. Rep. 2011/034. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2011/2011_034-eng.html

²⁸ DFO (2019). Stock Assessment of Atlantic Cod (*Gadus morhua*) in NAFO Divisions 4X5Y. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2019/015. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2019/2019_015-eng.html

Stock	Would the existing rebuilding plan have met the proposed timelines?	Details
		year rebuilding strategy was first implemented. ²⁹ The stock was first included in a population assessed as “special concern” by COSEWIC in 1998, ³⁰ and later as “endangered” in 2010. ³¹
Northern shrimp – SFA 6	Yes	There were approximately 21 months between the time it was determined the stock was below the LRP and the rebuilding plan being publicly available. The rebuilding plan was published in November 2018. ³² The stock was first noted as being in the critical zone during a stock assessment meeting held in February 2017. ³³ The stock was noted to be declining within the cautious zone since 2013/14 and close to the LRP in the assessment conducted in April 2016. ³⁴
Atlantic cod – 5Z	No	There were approximately 102 months between the time it was determined the stock was below the LRP and the rebuilding plan being publicly available. The rebuilding plan was published in June 2019. ³⁵ The stock was first noted as being in the critical zone during a stock assessment meeting held in December 2010. ³⁶ That meeting defined the LRP and indicated the stock had likely been below the LRP since 1994. The stock was first included in a population assessed as “special concern” by COSEWIC in 1998 ³⁷ and later as “endangered” in 2010. ³⁸ The stock is regularly assessed by the U.S.-Canada Transboundary Resource Assessment Committee (TRAC). The 2018 TRAC assessment was used to support the development of the rebuilding plan.
Yellowtail flounder – 5Z	Not applicable	This stock does not have a defined LRP. The rebuilding plan was published in June 2019. ³⁹ The stock appears to have been first officially noted publicly as being in the critical zone (but also as being without an LRP) in the 2015 results of the DFO Sustainability Survey for Fisheries and again in the 2016 results.

²⁹ DFO (2000). Southern Scotian Shelf and Bay of Fundy Cod (Div. 4X/5Y). DFO Sci. Stock Status Report A3-05(2000). <https://waves-vagues.dfo-mpo.gc.ca/Library/251507.pdf>

³⁰ Government of Canada (2011). Species Profile Atlantic Cod Maritimes Population. https://wildlife-species.canada.ca/species-risk-registry/species/speciesDetails_e.cfm?sid=763. Although this was contested by the report author, see: Bell, K. N. I. 1998. Status of Atlantic Cod, *Gadus morhua*, in Canada. Status report commissioned by COSEWIC. ~100 pp.+8 figs., 137 refs. (Officially unavailable; obtained from author: <http://www.ucs.mun.ca/~kbell/cod/BELLcodrep980204/BELLCod980204sbmtd.html>)

³¹ COSEWIC (2010). COSEWIC Assessment and Status Report on the Atlantic Cod *Gadus morhua* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 105 pp. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_Atlantic%20Cod_0810_e.pdf

³² DFO (2018). Annex J - Rebuilding Plan for Northern Shrimp SFA 6. In Integrated Fisheries Management Plan for Northern shrimp and striped shrimp – Shrimp fishing areas 0, 1, 4-7, the Eastern and Western Assessment Zones and North Atlantic Fisheries Organization (NAFO) Division 3M. Effective 2018. <https://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/shrimp-crevette/shrimp-crevette-2018-002-eng.htm>

³³ DFO (2017). An Assessment of Northern Shrimp (*Pandalus borealis*) in Shrimp Fishing Areas 4–6 and of Striped Shrimp (*Pandalus montagui*) in Shrimp Fishing Area 4 in 2016. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2017/012. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2017/2017_012-eng.html

³⁴ DFO (2016). An Assessment of Northern Shrimp (*Pandalus borealis*) in Shrimp Fishing Areas 4–6 and of Striped Shrimp (*Pandalus montagui*) in Shrimp Fishing Area 4 in 2015. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2016/028. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2016/2016_028-eng.html

³⁵ DFO (2019). Rebuilding Plan for Atlantic Cod - NAFO Division 5Z. <http://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/cod-morue/cod-morue-2019-eng.html>

³⁶ DFO (2011). Clark, D.C., K.J. Clark, and I.V. Andrushchenko. 2011. Precautionary Approach Limit Reference Points for Atlantic Cod (*Gadus morhua*) in NAFO Divisions 4X5Yb and 5Zjm. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/085: vi + 6p. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/ResDocs-DocRech/2011/2011_085-eng.html

³⁷ Government of Canada (2011). Species Profile Atlantic Cod Maritimes Population. https://wildlife-species.canada.ca/species-risk-registry/species/speciesDetails_e.cfm?sid=763. Although this was contested by the report author, see: Bell, K. N. I. 1998. Status of Atlantic Cod, *Gadus morhua*, in Canada. Status report commissioned by COSEWIC. ~100 pp.+8 figs., 137 refs. (Officially unavailable; obtained from author: <http://www.ucs.mun.ca/~kbell/cod/BELLcodrep980204/BELLCod980204sbmtd.html>)

³⁸ COSEWIC (2010). COSEWIC Assessment and Status Report on the Atlantic Cod *Gadus morhua* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 105 pp. https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_Atlantic%20Cod_0810_e.pdf

³⁹ DFO (2019). Rebuilding Plan for Yellowtail Flounder - NAFO Division 5Z. <http://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/flounder-limande/2018/index-eng.html>

Stock	Would the existing rebuilding plan have met the proposed timelines?	Details
		<p><i>However, the stock was classified as having an uncertain health status with serious harm possible in the most recent survey results (2017).⁴⁰ The rebuilding plan notes that although biomass reference points consistent with the precautionary approach framework have not been developed for this stock, all three survey indices for it are at their lowest point in the time series and well below historical values, indicating that the stock is in the critical zone. The stock is regularly assessed by the U.S.-Canada Transboundary Resource Assessment Committee (TRAC). The last accepted modelled assessment for this stock was conducted in 2013. As such, TRAC's 2018 empirical assessment (empirical) was used to support the development of the rebuilding plan. According to figures included in the most recent empirical assessment, the stock has been in decline since the early 2000s, after rebuilding from a previous collapse in the in the mid-1990s.^{41,42} This transboundary stock was included in a U.S. domestic rebuilding plan since at least 2008.⁴³</i></p>

⁴⁰ DFO (2019). Sustainability Surveys Data and Summaries. <https://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/survey-sondage/data-donnees-en.html>

⁴¹ Legault, C.M., & McCurdy, Q.M. (2018). Stock Assessment of Georges Bank Yellowtail Flounder for 2018. Transboundary Resources Assessment Committee Working Paper 2018/03. <https://www.nefsc.noaa.gov/assessments/trac/documents/gbyt-assessment-2018-v3.pdf>

⁴² Stone, H. H., Gavaris, S., Legault, C. M., Neilson, J. D., & Cadrin, S. X. (2004). Collapse and Recovery of the Yellowtail Flounder (*Limanda ferruginea*) Fishery on Georges Bank. Journal of Sea Research, 51(3-4), 261–270.

⁴³ DFO (2019). Rebuilding Plan for Yellowtail Flounder - NAFO Division 5Z. <http://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/flounder-limande/2018/index-eng.html>