

Fisheries Rebuilding Success Indicators

Introduction

Canada's marine fisheries are highly valuable: they are a major driver of our economy, shape our culture and sustain our coastal communities. Yet many of Canada's stocks are depleted, and it's estimated that 52 per cent of the biomass of Canadian fish has disappeared since 1970 (Hutchings et al. 2012). Canada has a good policy framework in place to manage fisheries, but many policy instruments have not been fully implemented or remain in draft form. The consistent application of these policy tools will be essential to ensuring the stability of healthy fisheries and rebuilding depleted stocks for the benefit of marine ecosystems, coastal communities and the fishing industry.

Building on Oceana Canada's 2016 report on the status of Canada's fish stocks (Baum and Fuller 2016), the current report has developed a series of indicators, to be updated annually, that provide the essential information to measure progress toward maintaining or rebuilding fisheries to healthy levels in Canada, and track how well Fisheries and Oceans Canada (DFO) is implementing its commitments from year to year.

Background

In June 2016, Oceana Canada published the most comprehensive public study ever conducted on the state of Canada's marine fisheries, [Canada's Marine Fisheries: Status, Recovery Potential and Pathways to Success](#) (hereafter, Oceana Canada 2016 report; Baum and Fuller 2016). Based on all publicly available information, the study revealed that less than a quarter of Canada's fish stocks could confidently be considered healthy (28 stocks of 125 examined) and that 18 (14.4 per cent) were in the critical zone, the majority of which were finfish. Almost none of these critical populations had rebuilding plans in place. The status of 42 per cent of all fish populations could not be determined due to an absence of basic or up-to-date information available to the public. These results differed from the 49 per cent of stocks the government claimed were healthy, based on a report published by Environment and Climate Change Canada (ECCC 2016; see 2014 results) earlier the same year that used the same data from DFO (Figure 1). Because ECCC did not explain how it arrived at their numbers, there was no way to independently verify this significant difference.

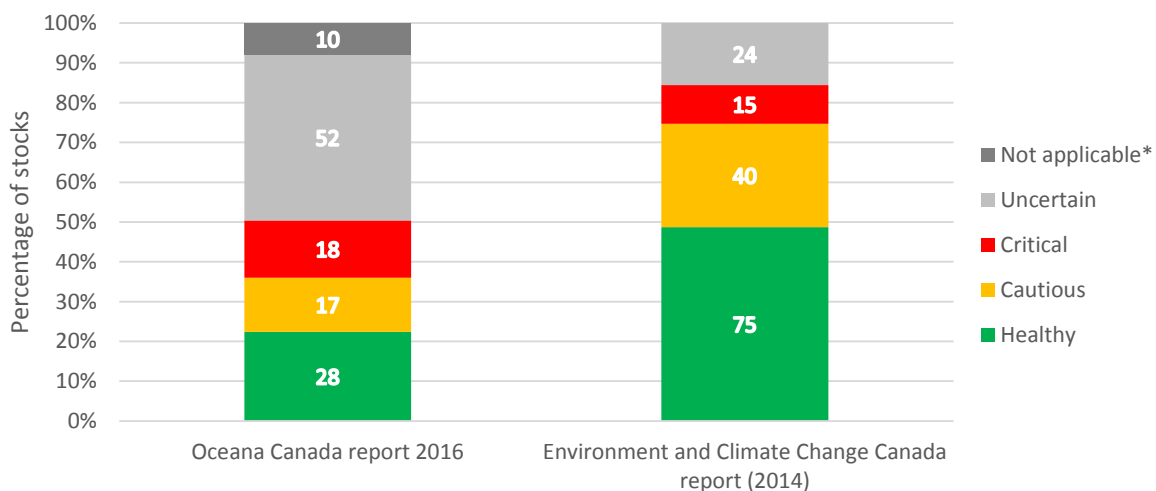


Figure 1. The percentage of stocks in each of DFO's Precautionary Approach (PA) framework health status zones, as reported in last year's Oceana Canada report (n=125 stocks; Baum and Fuller 2016) and earlier in the same year by Environment and Climate

*Change Canada (n = 154 stocks; ECCC 2016, see 2014 results). The number of stocks in each status zone is indicated in white font within the bars. *In the Oceana Canada report, Regional Fisheries Management Organization (RFMO)-assessed stocks were given a status of not applicable.*

Indicators to measure progress toward healthy fisheries in Canada

Building upon the Oceana Canada 2016 report, nine indicators were identified that provide the essential information to measure progress toward maintaining or rebuilding fisheries to healthy levels in Canada, and track how well DFO is implementing its commitments¹ from year to year. The current report examines changes in these indicators one year after releasing the initial report, demonstrating the extent of DFO's progress toward rebuilding, progress made in the last year and updating the status of Canada's marine fish and invertebrate populations.

This report uses newly available information published over the last year, and a stock list that is a combination of those included in the Oceana Canada 2016 report and the results of the 2015 *Sustainability Survey for Fisheries* (SSF), released in detail for the first time in October 2016 (DFO 2016).

Therefore, changes in stock status in this update likely reflect improved transparency and access to information rather than actual changes in the status of fish stocks. This stock list represents more marine fish and invertebrate stocks² managed within Canada and subject to targeted or incidental commercial fishing pressure than the SSF, which only includes major commercial stocks.

The indicators are summarized as follows:

1. **Status:** The number and percentage of stocks in the healthy, cautious, critical and uncertain categories. This information is essential to determine and prioritize management actions, including where rebuilding plans are needed. The first indicator provides a snapshot of the overall health of Canada's marine fish and invertebrate stocks.
2. **Stocks going from uncertain to having a status:** The number and percentage of stocks identified as having an unknown or uncertain status that now have a status assigned. 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 status of fewer stocks should remain uncertain.
3. **Change in status:** The number and percentage of stocks that became more or less at risk of depletion or stayed the same. This indicates how things have changed since the previous year. Over time, more stocks should move out of the critical and cautious zone and into the healthy zone.
4. **Biomass/abundance known:** The number and percentage of stocks with recent (less than or equal to five years) biomass/abundance estimates. This indicator shows how many stocks have recent estimates of abundance and how this changes from year to year. Given that DFO is moving toward two- to five-year assessment cycles for all major stocks (DFO 2016), this value should increase over time.
5. **Fishing mortality known:** The number and percentage of stocks that have an estimate of the removal rate of fish from the population, known as fishing mortality, as estimated from population

¹ In October 2016, the Commissioner of the Environment and Sustainable Development released an Auditor General report on Sustainable Fisheries (OAG 2016). It found that although DFO knows what tools are needed to sustainably manage our fisheries, for many stocks these tools have not been used, and DFO lacks the key information needed to effectively manage Canada's fish stocks. DFO has both acknowledged and committed to implementing all the report's recommendations.

² Excluding marine mammals, anadromous, and freshwater fish

models. Ideally, estimates will include information from all potential sources of mortality: directed commercial fisheries, recreational fisheries, bait fisheries, food-social-ceremonial fisheries and bycatch. One or more of these sources are often missing from mortality estimates. For some stocks, the data available, or the most appropriate modelling approach, simply does not allow for an estimation of fishing mortality. An increase in this indicator from year to year will indicate more stocks have the data and ability to use the models required to estimate mortality, and as a result, have more certainty in the outcomes of management decisions.

6. **Reference points:** The number and percentage of stocks that have targets, such as lower stock reference (LRP) and upper stock reference (USR) points. Reference points define the stock status zones, allowing an assessment of whether a stock is healthy, cautious or critical, and providing the basis for rebuilding plan goals. 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 (OAG 2016), more stocks are expected to have reference points 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. 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, including rebuilding from the cautious to the healthy zone. A transparent, fully accessible IFMP makes it easy to determine how a stock is managed, making it less vulnerable to bad decision-making. With DFO's commitment to developing and releasing IFMPs for all major stocks (OAG 2016), more of them are expected from year to year.
8. **Catch monitoring:** The number and percentage of stocks with at-sea/electronic monitoring, dock-side monitoring and logbooks that record the entire catch. Accurate estimates of how much of each species is caught and discarded provides fisheries managers with the key information required for informed fisheries-management decision-making. This indicator assesses how well our stocks are monitored. There are three common tools, each with some trade-offs. Dock-side 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 often does not record species discarded at sea. At-sea and electronic monitoring records the entire catch, both that which is retained and discarded. However, 100 per cent coverage is expensive and not needed for all fisheries. The entire catch can also be recorded in log books, in which fishers record information about their catch and activities. However, they are not always required to record the entire catch, and catches identified using species guides may not be reported accurately. By using a combination of catch monitoring tools, ideally recording the entire catch, fisheries managers will have the data required to effectively manage our fisheries. With the anticipated release of a national catch monitoring policy in 2017 (DFO 2017), more attention is expected from DFO to determine and ensure an appropriate level and type of catch monitoring in all our fisheries. This indicator should increase 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 incorporating the Precautionary Approach (PA). The PA 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 2009). Similar to an IFMP, a rebuilding plan provides a framework for the management of a fishery, with the additional requirements included to rebuild the stock out of the critical zone (DFO 2009),

preferably to a healthy state. Ideally, all stocks in the critical zone have rebuilding plans, and with DFO's commitment to accomplishing this (OAC 2016), this indicator is expected to increase from year to year.

Methods

The Oceana Canada 2016 report analyzed 125 stocks with recent assessments conducted, acknowledging that there is a greater number that are managed within Canada and subject to targeted or incidental commercial fishing pressure. To ensure the most complete marine fish and invertebrate stock list available was used, Oceana Canada merged the marine fish and invertebrate stocks included in its report³ with the marine fish and invertebrate stocks included in the 2015 *Sustainability Survey for Fisheries* (SSF), released in detail for the first time in October 2016 (DFO 2016).

DFO uses the SSF, formerly the 'fisheries checklist,' to track the performance of the fisheries it manages and its own progress on implementing the Sustainable Fisheries Framework (SFF). This is the same data source used by ECCO in its reports, although it was only released in detail (i.e., stock by stock) for the first time in October 2016 (DFO 2016). The SSF includes information on the status of each stock and the implementation of reference points. Stocks are selected based on their economic, ecological and/or cultural importance and the 2015 results included 159 stocks, 125 of which were marine fish or invertebrates (others were marine mammals, anadromous or freshwater fish) and were included in the merger. Salmon stocks are not included because of their complex biology and management, with both the Pacific and Atlantic coast having their own wild salmon policies separate from the SSF.

In this merger, a number of stock definition issues arose between the two sources, as these are not static nor are they always consistent. Sometimes new information about the distribution of a population can cause the definition to change to be more biologically relevant, or sometimes what constitutes a stock for assessment purposes differs from the definition for management purposes. When stocks overlapped, but did not merge directly, Oceana Canada turned to the most recent DFO science documents – Canadian Science Advisory Secretariat (CSAS) reports – using the definitions for which there was separate health status, reference points or catch advice.

Similarly, for overlapping stocks and for those that did merge directly, CSAS documents were used to settle any disagreements among the information used to calculate indicators (i.e., status, existence of reference points) present in the both sources. When the indicator information agreed, or was only present in one source or the other, the assumption was that the original source was correct. However, it should be noted that at times, the SSF results are based on expert opinion, whereas Oceana Canada's report required documented evidence available to the public.

Although the tables contained within Oceana Canada's 2016 report have all the information required to calculate all but the catch monitoring indicator, the SSF does not indicate if an estimate of fishing mortality is known. Thus, for any stocks originating only from the SSF, CSAS reports were used to determine if mortality was known.

To update the stock information in the merged dataset, Oceana Canada reviewed all CSAS Science Advisory Reports, Science Research Documents and Science Response Processes published from January 1, 2016, to June 19, 2017, for information pertaining to the indicators, updating them as required. When new stocks were found that were not included in the merged dataset, they were added. For

³ 123 marine fish and invertebrate stocks were included in the merger from the Oceana Canada 2016 report; 3 anadromous fish stocks were excluded since their life cycle is not exclusively marine.

Regional Fisheries Management Organization (RFMO)⁴-assessed and joint U.S./Canada-assessed stocks, relevant websites were reviewed for newly available information. To determine if stocks were included in IFMPs or rebuilding plans, DFO websites were reviewed for published plans.

Information required for catch monitoring indicators was not present in either source used to make the merged dataset, and these were updated for all stocks by searching through the most recent CSAS reports, publicly available IFMPs and CHPs and other DFO websites for references to catch monitoring tools (log books, at-sea and dockside monitoring) for the fisheries of each stock and, if applicable, whether or not the monitoring recorded the entire catch (retained and discarded). If there was no indication of the use of the monitoring tool in the documents and websites searched, 'uncertain' was assigned as the indicator value.

Often, more than one fishery catches a given stock, making assessments of catch monitoring on a given stock challenging (i.e., different targeted levels of at-sea observer coverage varying by gear-type). Therefore, possible indicator values were restricted to be broad enough (complete, partial, uncertain) to allow for an amalgamation of responses.

Within CSAS documents, the language describing reference points can be ambiguous, with terms such as 'calculated' or 'developed' but often little indication as to if they have been accepted and implemented. It was recognized 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 accepted by managers. Based on values found in the SSF, it appears that a similar approach was followed, with most scientists and managers using their expert opinion to modify their answer for reference points if they knew there was no acceptance, even if they were calculated.

Stocks assessed by RFMOs do not fall under DFO's PA framework, and instead use the framework of the assessing organization, which, if they exist, often have different criteria and definitions of health status zones and reference points. 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 (i.e., if current assessed biomass was less than B_{LIM} , or less than 40 per cent of B_{MSY} , the critical zone was assigned). Similarly, if there was a B_{LIM} indicated, this was counted as a LRP. Based on values found in the SSF, this approach appears to be consistent with how most scientists and managers responded for these stocks. Most RFMO-assessed stocks do not have biomass-based reference points analogous to DFO's USR, so for these stocks it was indicated that USR were not applicable.

Additionally, for some stocks not subject to a directed commercial fishery, DFO appears to be developing biomass recovery targets instead of reference points. These recovery targets seem to be analogous to LRPs, appearing to be ideally set at 40 per cent of B_{MSY} , however even within the CSAS reports concerning the same stock and process, there can be confusion about whether or not these correspond to LRPs (DFO2016c, Swain et al. 2016). Here biomass recovery targets developed by DFO were accepted as analogous to LRPs.

In determining if a stock had a recent (less than or equal to five years old) biomass/abundance estimate, the last year of data included in the assessment was used to assess how recent the estimate was. This

⁴ RFMO's include: the Northwest Atlantic Fisheries Organization (NAFO), the International Commission for the Conservation of Atlantic Tunas (ICATT), the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean/Inter-American Tropical Tuna Commission (WCPFC/IATTC), and the International Pacific Halibut Commission (IPHC).

reduced the confusion from the sometimes-long time periods (i.e., years) between assessments and their publication date.

Results/Discussion

The 2017 dataset includes a total of 194 marine fish and invertebrate stocks that are managed within Canada and subject to targeted or incidental commercial fishing pressure. This stock list is the most complete available to date, based on marine fish and invertebrate stocks included in Oceana Canada’s 2016 report, combined with those included in the SSF and the addition of any stocks with newly available information from departmental reports. It includes 64 stocks with the same definitions from both the 2016 report and the SSF; 38 added from the 2016 report that were missing from the SSF; 47 added from the SSF that were missing from the 2016 report; 31 that were identified from a merger of information from both sources; and 14 that were identified in new documentation in 2017 and added to the dataset (see Appendix I for a comparison of some indicator values among the datasets used to create the stock list, and the electronic supplement to obtain a spreadsheet of stocks included in 2017, with indicator values).

1. **Status:** In 2017, 35.6 per cent (69 stocks) of our marine fish and invertebrate stocks can confidently considered to be healthy. Further, 14.9 per cent (29 stocks) are cautious, 13.4 per cent (26 stocks) are critical, and the status of 36.1 per cent (70) remains uncertain. Even with the inclusion of more stocks and newly available data, these results indicate little change in the overall status of our fisheries from last year to the present (Figure 2, Table 1).

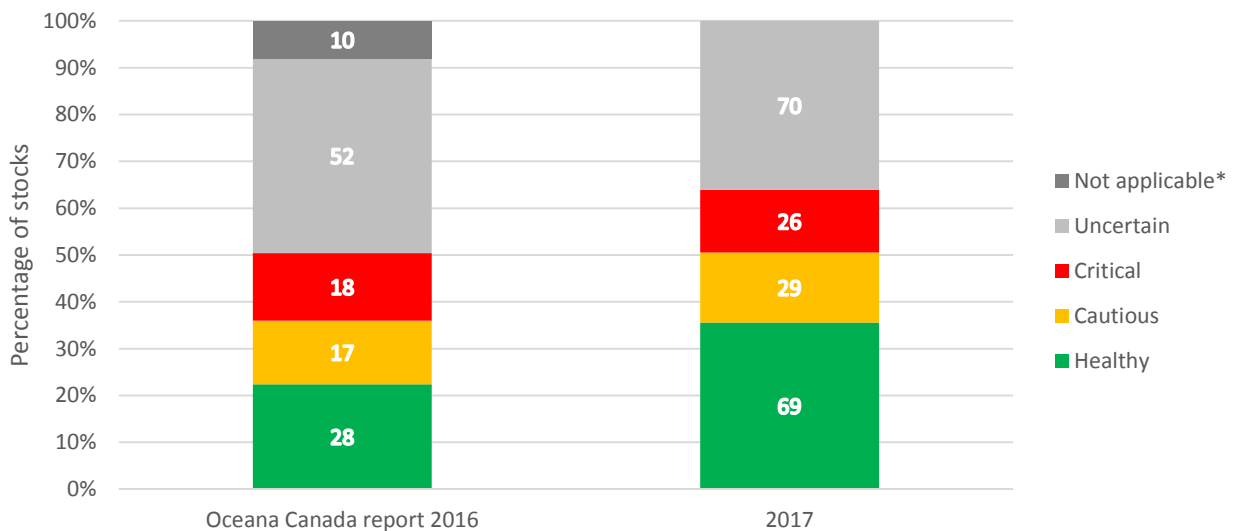


Figure 2. The percentage of stocks in each of DFO's Precautionary Approach (PA) framework health status zones in 2017 (n=194 stocks), and in last year's Oceana Canada report (n=125 stocks). The number of stocks in each status zone is indicated in white font within the bars. *In the Oceana Canada report, RFMO-assessed stocks were given a status of not applicable, but during the update, status was assigned based on biomass analogous to DFO's PA approach framework if possible, or they were considered uncertain.

2. **Stocks going from uncertain to having a status:** Sixteen stocks went from having an unknown/uncertain status in the 2016 report, to having one assigned in 2017 due to incorporating new information from the SSF (including that based on expert opinion) or newly published CSAS documents. Most these (10) are now considered healthy, while five are considered to be cautious and one critical. A further eight RFMO-assessed stocks went from having a status of not applicable to having a status assigned based on the process outlined above (one was classified

as uncertain). Two stocks underwent the reverse change, with the newly available reports unable to determine their status with certainty (one from healthy, and one from cautious to uncertain), which combined with the larger number of stocks included, increased the total number stocks with uncertain status from 52 to 70.

3. **Change in status:** During the 2017 update, five stocks from the 2016 report changed status. Two were identified as more at risk; Pacific ocean perch in the Queen Charlotte Sound declined from the healthy to the cautious zone, while spring spawning Atlantic herring in North Atlantic Fisheries Organization (NAFO) area 4T declined from the cautious to the critical zone. Three stocks were identified as less at risk, all improving from the cautious zone to the healthy levels (Atlantic halibut in NAFO 3NOPs4VWX+5, Northern shrimp in Pacific Shrimp Management Area 16 and the Fraser River Shrimp Management Area).
4. **Biomass/abundance known:** The percentage of stocks with a biomass or abundance estimate within the last five years decreased from 80 per cent (100 stocks) in the 2016 report to 65.5 per cent (127 stocks) in 2017 (Figure 3, Table 1). This result is not surprising, considering the stocks included in the 2016 report were chosen precisely because they had more recent assessment data available, while this year's stock list represents a more complete list of marine fish and invertebrate stocks managed by DFO. DFO is moving towards two- to five-year management and assessment cycle for many stocks, with interim reviews of stock indicators that could trigger full assessments (DFO 2016b). This should cause this indicator to increase over time, as more stocks that are rarely assessed are included in these cycles.
5. **Fishing mortality known:** The percentage of stocks with an estimate of fishing mortality increased from 12.8 per cent (16 stocks) in the 2016 report to 21.1 per cent (41 stocks) in 2017 (Figure 3, Table 1). This means more stocks have robust data that allows for the estimation of mortality, which is valuable in assessing whether or not overfishing is occurring (NOAA 2013). For some stocks, the data available or most appropriate modelling approach simply does not allow for an estimation of mortality. Sometimes total mortality (which also includes natural mortality, but doesn't allow for the separation of the two) can be estimated or a rough exploitation rate can be calculated (biomass/catch) and used to infer fishing pressure. Ideally, mortality can be estimated, and includes all sources of fishing mortality (Gilman et al. 2013); commercially directed, recreational, bait, food-social-ceremonial and bycatch.
6. **Reference points:** Although more stocks have LRPs in 2017 as compared to the 2016 report, the percentage of stocks with a LRP decreased from 61.6 per cent (77 stocks) to 53.6 per cent (104 stocks) in 2017 (Figure 3, Table 1). Similarly, although more stocks have USRs in 2017 as compared to the 2016 report, the percentage of stocks with an USR decreased from 45.6 per cent (57 stocks) to 43.3 per cent (84 stocks). DFO has committed to developing reference points for all major commercial fish stocks (OAG 2016), and appears to be making some progress. However, at the same time it is working on and publishing information on more stocks, making the relative proportion of stocks with reference points about the same.

Without reference points, it is difficult to apply the PA framework, assess stock health and set targets for rebuilding depleted stocks to healthy levels. With a little less than half of the marine fish and invertebrate stocks lacking LRPs and more than half lacking USRs, managers continue to operate without these benchmarks and the status of many stocks remains uncertain.

All critical zone stocks and 79 per cent (23 stocks) of cautious zone stocks have LRPs, or their equivalent. However, only 62 per cent (16 stocks) of critical zone and 62 per cent (18 stocks) of cautious zone stocks have USRs. For those stocks that are not doing well, without an USR there

is no target for rebuilding to a healthy state. Similarly, for some stocks not currently subject to directed fisheries, DFO appears to be only developing biomass recovery targets, to recover to the point where there is no longer a high risk of extinction, not to reach a healthy state. These recovery targets seem to be analogous to LRPs, appearing to be set at 40 per cent of B_{MSY} or a similar equivalent, however even within the CSAS reports concerning the same stock and process, there can be confusion about whether or not these correspond to LRPs (DFO2016c, Swain et al. 2016). Even if a stock is not subject to a directed commercial fishery, if it is subject to incidental commercial fishing pressure within Canada an USR or analogous biomass targets should be developed, ensuring the goal is to rebuild to a healthy state. Although the PA Framework applies to stocks subjected to commercial, recreational or subsistence fishing, it can be more broadly applied (DFO 2009).

7. Management plans in place: The percentage of stocks included in an Integrated Fisheries Management Plan (IFMP) increased from 64.0 per cent (80 stocks) in the 2016 report to 68.6 per cent (133 stocks) in 2017 (Figure 3, Table 1). DFO has committed to having all major commercial fish stocks included in IFMPs, and making these available to the public on its website (OAC 2016). Without the inclusion in a management plan, fish stocks lack the framework required for conservation and sustainable use, and it is difficult for stakeholders and the public to assess how a fishery is being managed. The majority of stocks are included in an IFMP, and the percentage of stocks included is increasing, but with more than one-third lacking a plan, there is considerable room for improvement.

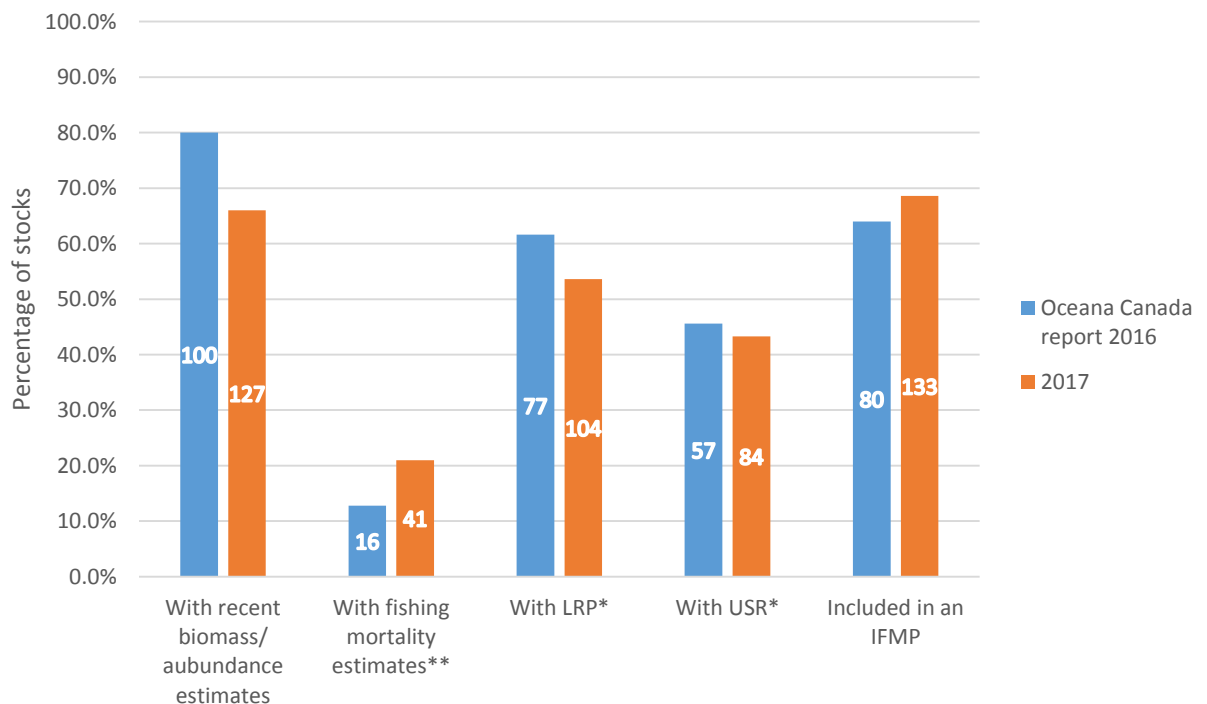


Figure 3. The percentage of stocks included in five indicators in 2017 (n=194 stocks) and the Oceana Canada 2016 report (n=125 stocks). The indicators included the percentage of stocks: 1) with a biomass/abundance estimate within the last five years; 2) with fishing mortality estimates; 3) included in an Integrated Fisheries Management Plan (IFMP); 4) with a limit reference point (LRP); and 5) with an upper stock reference point (USR). The number of stocks for each indicator is indicated in white font within the bars.

** RFMO-assessed stocks do not use DFO's Precautionary Approach. For these stocks if there was a B_{LIM} indicated, it was counted this as a LRP. However, most often 'not applicable' was assigned for USR for these stocks as there usually are no biomass-based reference points analogous to DFO's USR. **For some stocks, the data available or most appropriate modelling approach simply does not allow for an estimation of F.*

- 8. Catch monitoring:** In 2017, 70.6 per cent of marine fish and invertebrate (137 stocks) stocks have fisheries with at-sea observer or electronic monitoring (Figure 4, Table 1). Of these 137 stocks, forty-one have fisheries with 100 per cent monitoring while 96 have fisheries with varying monitoring levels. The presence of at-sea or electronic monitoring was uncertain in 29.3 per cent (57) of stocks.

Only 21.1 per cent (41) of marine fish and invertebrate stocks have fisheries with mandatory logbooks where it was clearly indicated in the materials searched that the entire catch (retained and discards) is recorded; 60.3 per cent (117) have fisheries that use logbooks but it was not clear in the materials searched whether the entire catch is recorded, and there is uncertainty about the use of logbooks in the fisheries of 18.6 per cent (36). 72.7 per cent (141) of marine fish and invertebrate stocks have fisheries that require some level of dockside monitoring of landings. Of these 141 stocks, a little more than half (79) have fisheries that are required to have 100 per cent of landings verified by a certified independent dockside monitor and a little less than half (62) having varying or unknown levels of dockside monitoring requirements. The use of dockside monitoring in the fisheries of 27.3 per cent of stocks (53) is uncertain.

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, as indicated by high number of stocks in the uncertain categories. Often, more than one fishery (i.e., gear-type/vessel size) catches a given stock, making assessments of catch monitoring on a given stock challenging (i.e., different levels of at-sea observer coverage varying by gear-type). Until DFO ensures all stocks are included in IFMPs, and that these and their associated vessel/gear-type specific Conservation Harvesting Plans (CHPs) for each fishery are made public, compiling information on the status of catch monitoring in our fisheries will remain challenging. DFO is currently reviewing the catch monitoring of fisheries in Canada, indicating that challenges and gaps exist, and is developing a national catch monitoring policy to be released in 2017 (DFO 2017). Good data provides the foundation for good management. Although the PA means being cautious when scientific knowledge is uncertain, and not using the absence of rigorous information as a reason not to take action, armed with accurate estimates of how much of each species are caught and discarded, fisheries managers will have the key information required for rigorous fisheries-management decision-making.

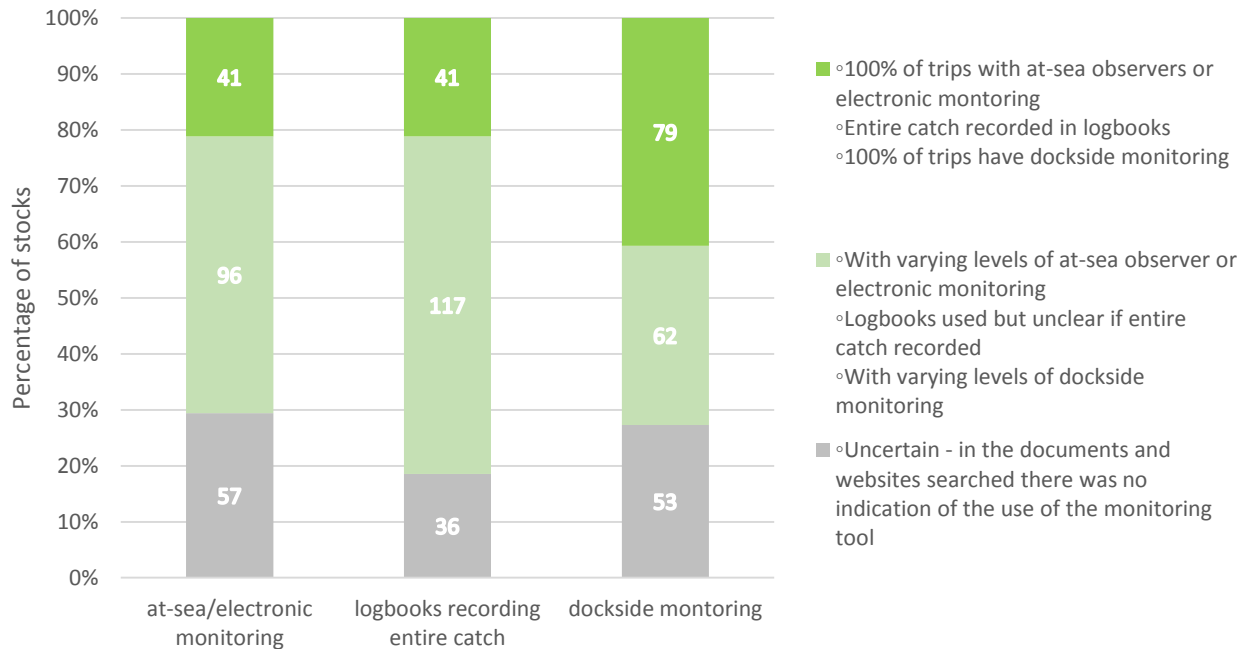


Figure 4. The percentage of Canada's marine fish and invertebrate stocks in 2017 (n=194 stocks) that have the following catch monitoring tools in place: 1) at-sea observer or electronic monitoring; 2) logbooks recording the entire catch; or 3) dockside monitoring. The number of stocks with each level of monitoring is indicated in white font within the bars.

9. Critical stocks with rebuilding plans: Although not reported in the 2016 report, the number of stocks in the critical zone with rebuilding plans remained the same in 2017, with three: northern Gulf of St. Lawrence cod, bocaccio rockfish and yelloweye rockfish - outside population (Table 1). Like IFMPs, rebuilding plans provide the framework, this time with the additional requirements to rebuild depleted fish stocks out of the critical, and ideally into the healthy zone. DFO has committed to developing rebuilding plans for all stocks in the critical zone (OAC 2016). The priority must be to complete this commitment as soon as possible, and in the meantime, prioritize among those in the cautious zone. According to DFO's guidelines for rebuilding plan development, rebuilding plans should be ready to come into effect when a stock reaches the boundary of the critical and cautious zones (DFO 2013). In addition to those mentioned for critical zone stocks above, DFO already has two rebuilding plans for cautious zone stocks (Atlantic cod in NAFO 3Ps, and Atlantic herring in southwest Nova Scotia/Bay of Fundy).

Conclusions

From the results above, a few conclusions can be drawn:

1. Significantly more information is available for analysis due to the public release of the SSF, as of October 2016 (DFO 2016). With funds allocated to update the SSF annually, and with new resources committed to science and fisheries management in DFO, the accuracy and completeness of information should continue to improve in years to come. This is assuming DFO continues to focus attention on increased transparency and rebuilding.
2. Most of the change seen over the past year is due to the incorporation of newly available information. By merging the results of the 2016 report with those of the 2015 SSF, and updating in 2017, the percentage of stocks that were identified as uncertain decreased, while the

percentage in the cautious and healthy zones increased. Still, in 2017 only 35.6 per cent (69 stocks) of our marine fish and invertebrate populations can confidently be considered healthy and 14.9 per cent (29 stocks) cautious, 13.4 per cent (26 stocks) critical and 36.1 per cent (70 stocks) uncertain. This differs from the values reported in the SSF in 2015 (DFO 2016), which reported approximately 50 per cent as being healthy, 20 per cent cautious and 12 per cent critical (see Table 2 in Appendix I). This is likely due in part to providing the most recent information here, but also to stock inclusion and definition differences. The stock list used here for 2017 is the most accurate and complete available, based on a merger of stocks included in our report published last year, combined with those included in the SSF and the addition of any stocks with newly available information from departmental reports. It is closer to representing all marine fish and invertebrate stocks⁵ that are managed within Canada and are subject to targeted or incidental commercial fishing pressure than the SSF, which only includes major commercial stocks.

3. Much work remains for DFO to implement existing policy tools and commitments. Compared to the 2016 report, in 2017 there is a lower percentage of stocks that have reference points, with almost half lacking a lower (46.4 per cent) and over half (56.7 per cent) lacking an upper reference point. Although there is a higher percentage of stocks that are included in an IFMP, there are still almost one-third of stocks lacking inclusion. DFO has developed work plans to establish reference points and a plan to complete IFMPs for all major stocks, with priorities identified for both for the fiscal year 2017-18, and planned annual prioritization updates until complete (DFO 2017). With this renewed commitment, these indicators should increase next year.
4. Catch monitoring is key to collecting robust data. According to the 2017 results, most of our marine fish and invertebrate stocks have catch monitoring tools in place, but it remains difficult to know if the tools are monitoring the entire catch (retained and discarded) and at what monitoring levels monitoring are being targeted and achieved. Furthermore, DFO does not provide a clear rationale for determining targeted levels of at-sea coverage and lacks systematic controls to ensure targets are met (OAC 2016). DFO is working on a national catch monitoring policy, including guidance on setting targets, with anticipated completion in 2017 (DFO 2017). With improved catch monitoring, fisheries managers will have the data required to effectively manage Canada's fisheries.
5. Last but not least, DFO still lacks rebuilding plans for most critical stocks (88.5 per cent), with only three rebuilding plans implemented for critical stocks. DFO's own SSF indicates plans are required for 16 more stocks, while our updated results for 2017, with a more complete stock list, indicates plans are required for 23 more. According to the PA Framework, all stocks within the critical zone must have rebuilding plans (DFO 2009). With DFO's commitment to accomplishing this (OAC 2016, DFO 2017), and the urgency with which the plans are needed, this indicator is expected to improve next year.

Recommendations

The new investments in science, actions on transparency, commitments to rebuilding plans and a national catch monitoring policy creates an unprecedented opportunity. An opportunity to accelerate the deployment of long-standing and critical policies to maintain and restore the health of Canada's oceans and fisheries, to ensure they remain a significant part of our culture, economy and a vital source of sustainable protein for the future.

The following actions are recommended for priority and completion within the next year:

⁵ Excluding marine mammals, anadromous, and freshwater fish

- Complete the rebuilding plans for the five stocks it has publicly committed to (Northern cod, Yelloweye rockfish (inside waters population), southwest Nova Scotia cod, and Redfish Unit 1 and Unit 2; Canada 2017a, Canada 2017b).
- Develop and release timelines and priorities for completing rebuilding plans for all stocks in the critical zone.
- Embed the duty to rebuild Canada's fish populations in the *Fisheries Act*.
- Complete and implement a national catch monitoring policy, making it mandatory for all commercial fisheries to have sufficient monitoring to ensure accurate estimates of all retained and discarded catches.
- Establish and release timelines and priorities for completing and sharing Integrated Fisheries Management Plans.
- Establish and release timelines and priorities for developing reference points, ensuring there is both an upper and a lower reference point for every stock.
- Continue to invest resources in conducting timely stock assessments using the best available information, including estimates of fishing mortality from all sources.






References

1. Baum, J.K. & Fuller, S.D. (2016). *Canada's Marine Fisheries: status, recovery potential and pathways to success*. Toronto, Ontario: Oceana Canada, 154 pp. www.oceana.ca
2. Canada. (2017a). Parliament. House of Commons. Standing Committee on Fisheries and Oceans. Evidence. (Issue No. 55, April 6, 2017) 42nd Parliament, 1st Session. <http://www.parl.gc.ca/content/hoc/Committee/421/FOPO/Evidence/EV8870047/FOPOEV55-E.PDF>
3. Canada (2017b). Government response to the tenth report of the standing committee on fisheries and oceans. https://www.ourcommons.ca/content/Committee/421/FOPO/GovResponse/RP9062095/421_FOPO_Rpt10_GR/421_FOPO_Rpt10_GR-e.pdf
4. DFO (2009). *A Fishery Decision-Making Framework Incorporating the Precautionary Approach*. <http://www.dfo-mpo.gc.ca/reports-rapports/regs/sff-cpd/precaution-eng.htm>
5. DFO (2013). Guidance for the Development of Rebuilding Plans under the Precautionary Approach Framework: Growing Stocks out of the Critical Zone. <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/precautionary-precaution-eng.htm>
6. DFO (2016). *Sustainability Survey for Fisheries*. Fisheries and Oceans Canada. <http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/survey-sondage/index-en.html>
7. DFO (2016b). Guidelines for providing interim-year updates and science advice for multi-year assessments. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2016/020. <http://waves-vagues.dfo-mpo.gc.ca/Library/365593.pdf>
8. DFO. (2016c). Recovery Potential Assessment for White Hake (*Urophycis tenuis*): Population of the Southern Gulf of St. Lawrence. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2016/034. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2016/2016_034-eng.pdf
9. DFO. (2017). Management Action Plan. Reports of the Commissioner of the Environment and Sustainable Development Report 2 – Sustaining Canada's Major Fish Stocks. Date: Fall 2016. <http://www.dfo-mpo.gc.ca/ae-ve/audits-verifications/16-17/map-eng.html>

10. ECCC (Environment and Climate Change Canada) (2016). Canadian Environmental Sustainability Indicators: Status of Major Fish Stocks. Consulted on 22 February 2016. Available at: <https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=1BCD421B-1>
11. Gilman, E., Suuronen, P., Hall, M., & Kennelly, S. (2013). Causes and methods to estimate cryptic sources of fishing mortality. *Journal of Fish Biology* 83: 766-803.
12. Hutchings, J.A., Côté, I.M., Dodson, J.J., Fleming, I.A., Jennings, S., Mantua, N.J., Peterman, R.M., Riddell, B.E., Weaver, A.J. & VanderZwaag, D.L. (2012). Sustaining Canadian marine biodiversity: responding to the challenges posed by climate change, fisheries, and aquaculture. Expert panel report prepared for the Royal Society of Canada, Ottawa.
13. Office of the Auditor General (OAG). (2016). *Report 2 – Sustaining Canada’s Major Fish Stocks*. Fisheries and Oceans Canada. http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201610_02_e_41672.html#p19
14. NOAA. (2013). National Marine Fisheries Service DESCRIPTION OF METHODOLOGY FOR DETERMINING OVERFISHING AND OVERFISHED STATUS. http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2013/methodology.pdf
15. Swain, D.P., Savoie, L., & Cox, S.P. (2016). Recovery potential assessment of the Southern Gulf of St. Lawrence Designatable Unit of White Hake (*Urophycis tenuis* Mitchill), January 2015. DFO Can. Sci. Advis. Sec. Res. Doc. 2016/045. vii + 109 p. http://publications.gc.ca/collections/collection_2016/mpo-dfo/Fs70-5-2016-045-eng.pdf

Tables

The percentage (and number) of stocks for each indicator in 2017 and as reported in last year's Oceana Canada report. For indicators expressing change, the blue arrows and delta symbol indicate the change is calculated from the Oceana Canada 2016 report to 2017.

Indicator	Details	2017	Oceana Canada report - 2016
	Number of stocks	197	125
1. Status	% (number) of stocks 'healthy'	35.6% (69)	22.4% (28)
	% (number) of stocks 'cautious'	14.9% (29)	13.6% (17)
	% (number) of stocks 'critical'	13.4% (26)	14.4% (18)
	% (number) of stocks 'uncertain'	36.1% (70)	41.6% (52) <i>*plus 10 or 8.0% Not Applicable</i>
2. Stocks going from uncertain to having a status	% (number) of stocks that went from uncertain status to known [†]	8.2% (16) <i>and 9 RFMO stocks went from 'not applicable' to having a status assigned as described in the methods, while 2 stocks when from having a status to being uncertain</i>	
3. Change in status	% (number) of stocks that have changed status [†]	2.6% (5) <i>and – 47 new stocks were added from the SSF and 14 from new documents during the update process</i>	
	% (number) of stocks that are less at risk (increased status) [†]	1.5% (3)	
	% (number) of stocks that are more at risk (decreased status) [†]	1.0% (2)	
	% (number) of stocks remaining the same (same status) [†]	52.1% (101)	
4. Biomass/abundance known	% (number) of stocks with recent (<= 5 years) biomass/abundance estimates	65.5% (127)	80.0% (100)
5. Fishing mortality (F) known	% (number) of stocks with 'F' known*	21.1% (41)	12.8% (16)
6. Reference points	% (number) of stocks with LRP	53.6% (104)	61.6% (77)
	% (number) of stocks with USR	43.3% (84)	45.6% (57)
7. Management plans in place	% (number) of stocks in an IFMP	68.6% (133)	64.0% (80)
8. Catch monitoring	% (number) of stocks with at-sea/electronic monitoring	70.6%(137) <i>[41 at 100%, 96 with varying levels, and 57 uncertain**]</i>	Not available

Indicator	Details	2017	Oceana Canada report - 2016
	% (number) of stocks with logbooks recording the entire catch***	Yes – 21.1% (41) Partial – 60.3% (117) Uncertain – 18.6% (36)	Not available
	% (number) of stocks with dockside monitoring	72.7% (141) [79 at 100%, 62 with varying requirements and 53 uncertain**]	Not available
9. Critical stocks with rebuilding plans	% (number) of 'critical' stocks with rebuilding plans	10. (3)	Not available

*F' = Fishing mortality estimated. Sometimes this is not possible with available data or models used.

** Uncertain means that in the documents and websites searched there was no indication of the use of the monitoring tool.

*** 'Yes' means logbooks are mandatory and it was clearly indicated the entire catch (both retained and discarded) is recorded.

'Partial' means the log books are used but it wasn't clear if the entire catch is recorded, and 'Uncertain' means that in the documents and websites searched there was no indication of the use of logbooks as a monitoring tool.

†For assessing change in individual stock status between the 2017 results and the Oceana Canada 2016 report, stocks are required to have been present in both datasets. When the merger of stocks between the SSF and the Oceana Canada 2016 report resulted in a split of amalgamated stocks, for comparison purposes these split stocks were assigned the amalgamated status for 2016. Percentages in these sections are calculated as a percentage of the overall 2017 stock list that changed during the update. The number of newly added stocks appears as a comment under the third indicator of the number of stocks changing status.

Appendix 1: Detailed comparison of key indicator values in 2017 to previous datasets

* Please see the electronic supplement for a detailed spreadsheet including values used to calculate the 2017 indicators, stock by stock.

The percentages (and number) of stocks for some of the key indicator values in 2017 compared to the values in: 1) Oceana Canada's 2016 report, 2) all stocks in the 2015 results of the Sustainability Survey for Fisheries (SSF), 3) only marine fish and invertebrates stocks in the 2015 results of the SSF, and 4) a merger of the Oceana Canada 2016 report information with the information about marine fish and invertebrate stocks included in the results of the 2015 Sustainability Survey for Fisheries (SSF) (Merged SSF and Oceana Canada report), prior to the 2017 update.

Indicator details	2017	Merged SSF and Oceana Canada report	SSF (2015) – marine fish and invertebrates*	SSF (2015) – all stocks	Oceana Canada 2016 report
Number of stocks	194*	180	126**†	159	125†
% (number) of stocks 'healthy'	35.6% (69)	38.8% (70)	50.0% (63)	49.1% (78)	22.4% (28)
% (number) of stocks 'cautious'	14.9% (29)	16.1% (29)	16.7% (21)	19.5% (31)	13.6% (17)
% (number) of stocks 'critical'	13.4% (26)	13.3% (24)	13.5% (17)	11.9% (19)	14.4% (18)
% (number) of stocks 'uncertain'	36.1% (70)	31.6% (57)	19.8% (25)	19.5% (31)	41.6% (52) plus 8.0% (10) Not Applicable††
% (number) of stocks with LRP	53.6% (104)	54.4% (98)	60.0% (75)	54.7% (87)	61.6% (77)
% (number) of stocks with USR	43.3% (84)	44.4% (80)	50.8% (64)	47.2% (75)	45.6% (57)
% (number) of stocks in an IFMP	68.6% (133)	72.8% (131)	74.6% (94)	73.0% (116)	64.0% (80)
% (number) of 'critical' stocks with rebuilding plans	11.5% (3)	12.5% (3)	17.6% (3)	15.8% (3)	Not available

*Stocks in the 2017 update include those identified in the merger of Oceana Canada's 2016 report with the marine fish and invertebrate stocks included in the SSF 2015 results, and those added during the 2017 update from new stocks identified in Canadian Science Advisory Secretariat (CSAS) Science Advisory Reports, Science Research Documents and Science Response Processes published from January 1, 2016, to June 19, 2017.

**Marine mammals, anadromous and freshwater fish removed to enable comparisons to the Oceana Canada 2016 report and 2017 results.

†Even though the total number of stocks included in each dataset is close, they are not the same stocks. The sources agreed on stock definitions for 64 marine fish and invertebrate stocks, with the rest either overlapping with differing definitions, or completely missing from one or the other.

††Regional fisheries management organization (RFMO) assessed stocks were assigned a status of not applicable in the Oceana Canada 2016 report since they do not fall under the PA Framework. In the 2017 update these stocks were assigned a status analogous to DFO's PA framework.