

Missing the safety net: evidence for inconsistent and insufficient management of at-risk marine fishes in Canada

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Abstract: Marine conservation is often perceived as being in conflict with fisheries management. In Canada, at-risk marine fishes denied listing under the Species at Risk Act (SARA) are meant to receive comparable measures under the Fisheries Act. We assess the effectiveness of these Acts by examining (i) how long it takes a marine fish assessed as being at risk to move through the process and receive conservation measures, (ii) whether there are biases against marine fishes in the SARA process additional to the known listing bias, and (iii) when denied listing, to what extent these species are protected by the Fisheries Act. Overall, at-risk marine fishes typically spend 3.25 years under consideration for SARA, during which time they receive no additional protection. Endangered and Threatened marine fishes (i.e., those most at risk) face the greatest bias and receive the least protection; their SARA decisions are typically delayed, with almost 5 years usually passing between their COSEWIC (Committee on the Status of Endangered Wildlife in Canada) assessment and listing decision; most (70.6%) are then denied listing, after which the Fisheries Act provides few of the SARA-required measures. For SARA-listed marine fishes, recovery strategies are usually late and to date no action plans have been produced. Marine fish conservation is hindered by SARA's slow pace, incomplete recovery measures, and inadequate implementation of the Fisheries Act. We provide recommendations for improving conservation of at-risk marine fishes in Canada.

Résumé : La conservation d'espèces marines est souvent perçue comme entrant en conflit avec la gestion des pêches. Au Canada, les poissons marins en péril qui ne sont pas inscrits en vertu de la Loi sur les espèces en péril (LEP) sont censés faire l'objet de mesures semblables en vertu de la Loi sur les pêches. Nous évaluons l'efficacité de ces lois en examinant (i) le temps nécessaire pour le processus faisant en sorte qu'un poisson marin jugé en péril fasse l'objet de mesures de conservation, (ii) s'il existe des biais contre les poissons marins dans le processus de la LEP autres que le biais d'inscription connu et (iii) dans les cas où les espèces n'obtiennent pas l'inscription, dans quelle mesure ces espèces sont protégées par la Loi sur les pêches. Globalement, l'examen des poissons marins en péril en vue de leur inscription en vertu de la LEP dure typiquement 3,25 années, période durant laquelle ils ne bénéficient d'aucune protection supplémentaire. Les espèces en voie de disparition ou menacées (c.-à-d., les plus à risque) font l'objet du biais le plus important et de la protection la plus faible; les décisions en vertu de la LEP les concernant sont généralement retardées, presque 5 années s'écoulant habituellement entre leur évaluation par le COSEPAC (Comité sur la situation des espèces en péril au Canada) et la décision quant à leur inscription; la plupart (70,6 %) sont rejetés, après quoi la Loi sur les pêches ne prévoit que peu des mesures requises par la LEP. Pour les poissons marins désignés en vertu de la LEP, les stratégies de rétablissement sont habituellement tardives et, à ce jour, aucun plan d'action n'a été produit. La lenteur du processus de la LEP, des mesures de rétablissement incomplètes et l'application inadéquate de la Loi sur les pêches nuisent à la conservation des poissons marins. Nous formulons des recommandations pour améliorer la conservation des poissons marins en péril au Canada. [Traduit par la Rédaction]

Introduction

Conservation and recovery measures for marine fish species often are difficult to achieve because of perceived threats to existing commercial fisheries, as well as ongoing debate as to whether these species should be managed as wildlife or as commercial entities (Reynolds et al. 2005; Salomon et al. 2011). At the international level, not a single marine fish was listed on the Convention on International Trade in Endangered Species (CITES) until 2002 when seahorses were put on Appendix II (Vincent et al. 2014), and to this day listings continue to focus on nontarget species, with the addition of several shark and ray species in 2013 (CITES 2013). This may in part be due to the fact that certain member States of the Food and Agriculture Organization (FAO) have suggested that CITES is irrelevant to fisheries management and should therefore not be used as a conservation tool for commercially exploited aquatic species (Vasconcellos 2013). Yet in an evaluation of its applicability and relevance as an instrument for fisheries management, CITES has been found to not only be appropriate

but also important for promoting effective fisheries management (Vincent et al. 2014). Interestingly, although fisheries and conservation scientists remain in disagreement on the appropriate management regime for exploited marine fish, they generally agree on the status of these species (Davies and Baum 2012).

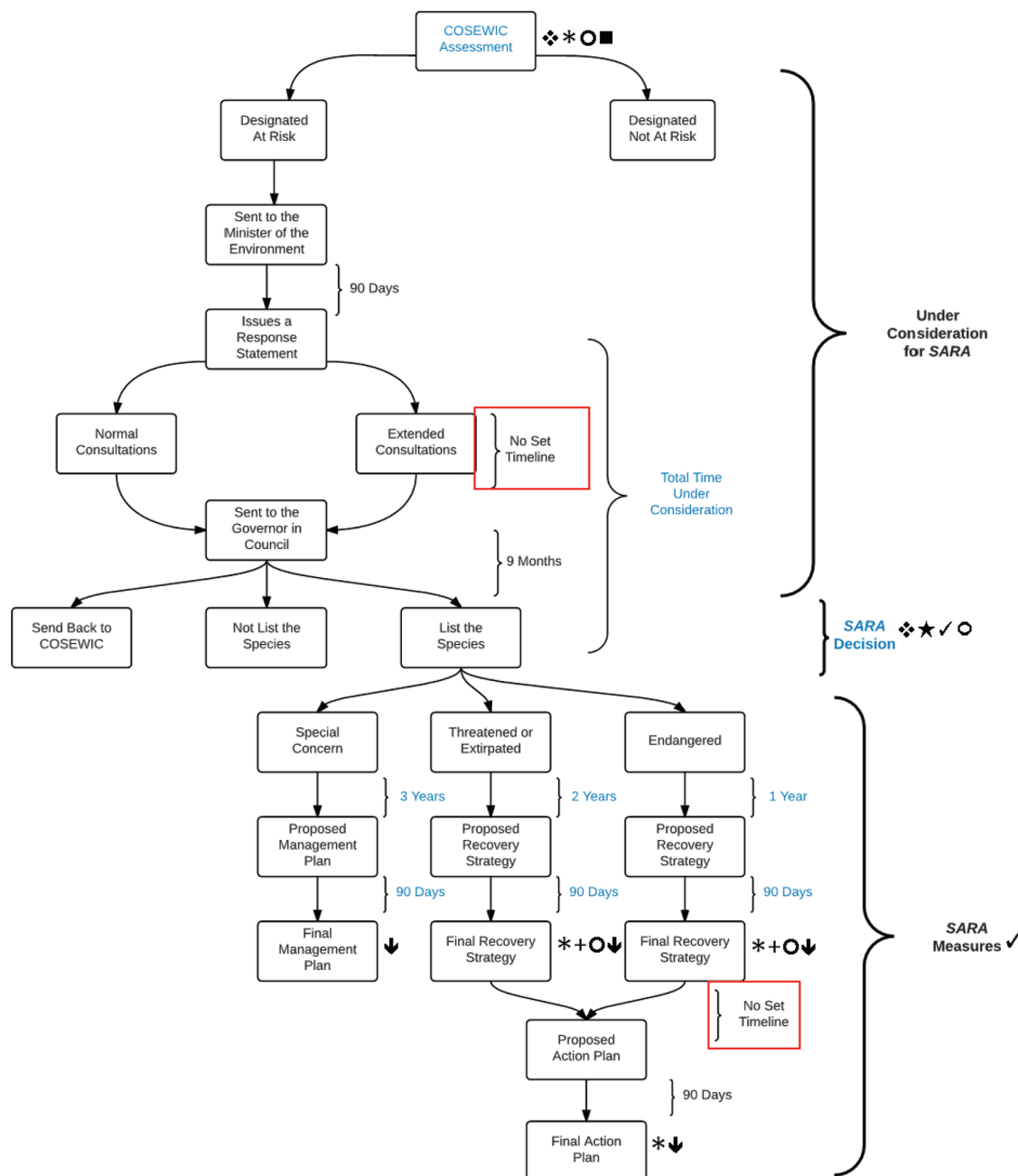
As the country with the world's longest coastline and highly valuable fisheries (export value upwards of CAN\$4.1 billion in 2012), Canada experiences similar tensions between marine fish conservation and fisheries management (Fisheries and Oceans Canada 2013a). Commercially exploited marine fishes are managed in Canada primarily under the Fisheries Act. When marine fishes are assessed by Canada's independent scientific body COSEWIC (the Committee on the Status of Endangered Wildlife in Canada) to be at risk, they then undergo a listing process under the federal Species at Risk Act (SARA). In force as of 2002, this legislation is meant to preserve Canadian wildlife species by preventing their extirpation and extinction, by creating recovery strategies and action plans for endangered and threatened species, and by preventing additional species from becoming at risk

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Fig. 1. Flowchart of steps and timelines in the Species at Risk Act (SARA) process, from the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessment to the SARA decision and the implementation of measures for listed species. Blue lettering denotes parts of the process evaluated in this study. Symbols denote parts of the process evaluated for marine fishes in previous studies (as detailed in Table S1¹): ♦ = Hutchings and Festa-Bianchet 2009, Powles 2011, Waples et al. 2013; * = Mooers et al. 2010; ○ = Favaro et al. 2014; ■ = Prugh et al. 2010; ★ = Mooers et al. 2007, Findlay et al. 2009, Dawe and Neis 2012, Schultz et al. 2013; ✓ = Vanderzwaag and Hutchings 2005; + = McCune et al. 2013, Taylor and Pinkus 2013; ↓ = Office of the Auditor General Canada 2013.



(Government of Canada 2012). If listed under SARA, all individuals of species designated as Threatened, Endangered, or Extirpated are meant to be provided immediate protection, along with their “residence” and their critical habitat; those species deemed to be at lower risk may be listed as Special Concern. If denied listing under SARA, management of marine fishes remains with Fisheries and Oceans Canada (formerly Department of Fisheries and Oceans, DFO) and under the Fisheries Act these species are meant

to receive effective management measures consistent with the conservation objectives, targets, and timelines of SARA.

Examination of SARA listing decisions and recovery strategy implementation (Fig. 1) has revealed the legislation to be of limited utility for marine fishes as currently implemented (see online supplementary material, Table S1¹). Many studies have demonstrated a bias against listing marine fishes under SARA (Vanderzwaag and Hutchings 2005; Mooers et al. 2007; Hutchings and Festa-Bianchet

¹Supplementary data are available with the article through the journal Web site at <http://nrcresearchpress.com/doi/suppl/10.1139/cfjas-2015-0030>.

2009), which appears to stem from their economic value. Initial studies found that marine fishes were more likely to be denied SARA listing if they were a target of, or associated with, a commercial fishery (Mooers et al. 2007; Findlay et al. 2009), while a recent analysis showed that, to date, any marine fish species with an estimated nonzero socio-economic cost of listing has been denied SARA listing (Schultz et al. 2013). Protection for those marine fish species listed on SARA also appears to be limited in that their required SARA recovery strategies are seldom developed (Mooers et al. 2010; McCune et al. 2013). Indeed, the Canadian federal government currently faces court challenges for failing to create recovery strategies and protect critical habitat of Threatened and Endangered species, including the white sturgeon (*Acipenser transmontanus*) (Pinkus 2014). Additionally, in its 2013 audit of SARA implementation, the Commission on Environment and Sustainable Development (CESD) reported that 55% of recovery strategies were more than 3 years overdue, critical habitat had not been identified in 66% of recovery strategies, and only 3% of required action plans had been completed for marine species (not just marine fishes) (Officer of the Auditor General of Canada 2013).

Despite the strong bias against listing marine fishes on SARA, there has been no evaluation to date of the management measures implemented through the Fisheries Act for these at-risk species. Over the past decade, DFO has attempted to demonstrate that its fisheries are being managed sustainably, for example, through industry-led certification by the Marine Stewardship Council (MSC, a third-party certification system). The efficacy of this approach also has yet to be assessed.

Here, we sought to identify mechanisms for improved conservation of at-risk marine fishes within Canada's current policy framework, by examining (i) the SARA process in detail to determine exactly where and how it is failing marine fishes and (ii) whether conservation measures comparable to those mandated by SARA are being implemented through the Fisheries Act for those marine fishes denied SARA listing. To address the first question, we conducted an updated assessment of SARA listing decisions for marine fishes and a novel timeline analysis examining how long it takes for marine fishes to move through the overall SARA process and whether individual SARA deadlines are adhered to (Fig. 1). We tested for differences (i) between at-risk marine and freshwater fishes and for at-risk marine fishes, (ii) across COSEWIC statuses, and (iii) between the Atlantic and Pacific oceans. We addressed the second question by examining if the Fisheries Act and related policy frameworks include provisions that could be considered as conservation measures equivalent to those in SARA and by evaluating existing policies and measures under the Fisheries Act for marine fish species with SARA decisions, comparing species (i) listed under SARA with those denied listing, (ii) across COSEWIC statuses, and (iii) between the Atlantic and Pacific oceans. We also assessed how MSC considers Canada's at-risk marine fishes when certifying fisheries. For both questions, we present two case studies of at-risk marine fishes that compare species with similar life-history characteristics and population statuses. Finally, based on our findings, we identify future actions to improve conservation for at-risk marine fishes in Canada.

The Canadian conservation and management framework

To facilitate examination of how conservation legislation interfaces with fisheries management and certification schemes within Canada, we first provide a brief overview of the mandates and procedures of COSEWIC, SARA, the Fisheries Act, and MSC. For a more detailed overview of the COSEWIC and SARA processes, see Hutchings and Festa-Bianchet (2009) and Mooers et al. (2010), respectively.

Conservation: the COSEWIC and SARA processes

COSEWIC conducts formal threat assessments for species that are potentially at risk using methods consistent with those of the International Union for the Conservation of Nature's (IUCN) Red List (COSEWIC 2014). If the assigned COSEWIC status is Special Concern, Threatened, Endangered, or Extirpated, the species is deemed to be "at risk" and must be considered for listing under SARA (Government of Canada 2012). The species' assessment proceeds through a series of steps and public consultations, some with no set deadline, before the Governor in Council publishes the final listing decision (Fig. 1).

Once a species is listed under SARA, the Act's legal provisions are enacted (Canada Gazette 2013), and recovery strategies, action plans, or management plans must be developed, each with their own set timelines (Fig. 1; Government of Canada 2014). For Endangered, Threatened, and Extirpated species, a recovery strategy must address the threats to the species' survival and identify the location of, and threats to, its critical habitat (i.e., "... the habitat that is necessary for the survival and recovery of a listed wildlife species"; Government of Canada 2002). If recovery is deemed to be technically and biologically feasible, an action plan must be created, demonstrating how the recovery strategy will be implemented and how its goals will be met. In lieu of recovery strategies and action plans, Special Concern species are only required to have a management plan (Fig. 1).

Officially, species assessed by COSEWIC are categorized either as being "listed" or "not listed" on SARA, with the latter including both those species that are under consideration for listing and those denied listing. Here, to more closely assess the SARA process and timelines, we considered species as "not listed" only if they had been denied listing on SARA and to be "under consideration" if they had never previously had a decision from SARA.

Management: the Fisheries Act

Canada's Fisheries Act provides for the conservation and management of fisheries as well as protection of fish habitat. However, revisions to the Fisheries Act in 2013 reduced the number of species eligible for habitat protection by narrowing the focus of the Act to commercial, recreational, and aboriginal fisheries and combining previous sections of the Act that protected fish from threats other than fishing (Fisheries and Oceans Canada 2013b). The primary tools for managing commercial fisheries are Integrated Fisheries Management Plans (IFMPs). These plans "guide the conservation and sustainable use of marine resources. IFMPs are developed to manage the fishery of a particular species in a given region and are the primary vehicle to set out harvesting and conservation measures. IFMPs combine the best available science on a species with industry data on capacity and methods for harvesting that species" (Fisheries and Oceans Canada 2014a). The 2009 Sustainable Fisheries Framework (SFF) is the overarching policy suite that has been developed by DFO to address conservation issues relating to commercial fisheries populations (Fisheries and Oceans Canada 2009a). The framework includes conservation and sustainable use policies that are to apply the precautionary approach, guidance for the development of rebuilding plans, managing fisheries for forage species, bycatch management, and protection of sensitive benthic areas. The SFF also outlines how its policies will be implemented through IFMPs.

MSC certification

The MSC, the largest global certification system for fisheries, has three main principles: (1) sustainable fish stocks (target species), (2) minimizing environmental impact, and (3) effective management (Marine Stewardship Council 2010). The MSC manages most at-risk species that are caught as bycatch under its second principle, and provisions must be made to ensure that "the fishery does not pose a risk of serious or irreversible harm ... or hinder recovery" to these species (Marine Stewardship Council 2012).

However, MSC does not recognize the at-risk status of many Canadian species; the only recognized “Endangered–Threatened–Protected (ETP)” species are those that are **listed** under SARA or recognized under “binding international agreements to which the jurisdictions controlling the fishery under assessment are party”, such as CITES.

Methods

Data

For every marine fish species designated to be at risk, we collated and reviewed the most recent available COSEWIC assessment, COSEWIC status report, response statement, SARA measure (i.e., recovery strategy, management plan and (or) action plan), and listing order from the Canada Gazette. To assess potential biases against marine fishes, we collated the same documents for all at-risk freshwater fishes and compared outcomes between these two groups. All documents were obtained from the SARA public registry.

To determine if the Fisheries Act management frameworks include conservation measures equivalent to those of SARA, we compared elements of SARA recovery strategy and action plan templates with elements of the IFMP template and the SFF policies. We then selected IFMPs that interacted with any marine fish species with a SARA decision (listed or not-listed species) by searching IFMPs and the associated COSEWIC assessment. We refer to each of these as an “IFMP-at-risk species interaction” and note that each IFMP can interact with multiple at-risk species, and vice versa. We obtained the IFMPs from the DFO website and if not available online we requested them from the various DFO regions. Occasionally a public version of the IFMP did not exist or the most recent version was not available. In the latter situation, we evaluated the outdated but publicly available version.

SARA evaluation

We examined SARA listing decisions for marine and freshwater fishes and then conducted a timeline analysis, assessing how long it takes these at-risk species to move through the various steps in the SARA process (Fig. 1). We calculated the total time under consideration as the time from the date of the associated response statement issued from the Minister of the Environment to (1) the date of the published listing decision for each species with a SARA decision and (2) the data of our most recent analysis, 1 June 2014, for each species still under consideration (Fig. 1). Two marine species, Atlantic cod (*Gadus morhua*; Laurentian North, Newfoundland and Labrador populations) and cusk (*Brosme brosme*), which have been denied SARA listing and are up for consideration again, were included in the “not-listed” category and also in the “under consideration” analysis. For each listed species, we then assessed whether SARA measures were created on time by calculating the punctuality of (i) the proposed recovery strategies or management plans (calculated by comparing the date of the listing decision with the date of the proposed plan or strategy; Fig. 1) and (ii) the final versions of these measures (calculated by comparing the date of the proposed measures with the date of the final plan or strategy; Fig. 1). “Latency” was then calculated as the time taken over time allowed. We note that because no action plans have yet been created for marine fish, we were unable to include them in the analysis.

We also attempted to answer the question “In Canada, how long does it take for a marine fish assessed as being at risk to receive conservation measures?”. To do so, we calculated the time from the date of the COSEWIC assessment announcing the species as being at risk to the date of (i) when its final recovery strategy or management plan was created, for those species listed on SARA, or (ii) its listing decision, for those species not listed on SARA, after which they are meant to receive protection under the Fisheries Act. For the former, we did not include those species automati-

cally listed on SARA in 2003 or those without finalized measures. In both cases, when species had multiple COSEWIC assessments, we used the first assessment unless it was from before SARA’s 2003 proclamation.

IFMP evaluation

We evaluated each IFMP-at-risk species interaction for inclusion of eight basic conservation measures: (1) harvest control (i.e., either quota or effort control) measures for the at-risk species, (2) precautionary approach reference points (e.g., limit or conservation reference points) for the at-risk species, (3) reference to the SFF’s bycatch policy and (4) implementation of bycatch mitigation measures, (5) reference to the SFF’s Sensitive Benthic Areas (SBA) policy, (6) SBA closures, (7) habitat protection for the at-risk species, and (8) spatial closures or time–area closures (e.g., spawning grounds of the fishery’s target species). For each of these eight measures, we calculated the percentage of IFMP-at-risk species interactions in which they are included. For each at-risk marine species, we assessed the extent of their protection by calculating the percentage of measures included in each of their IFMP-at-risk species interactions. Our evaluation of each measure was binary (included or not included) and did not take into account the extent to which each measure was implemented (e.g., number of bycatch measures or number of area closures), nor could we evaluate if measures are effective or adequately enforced.

Regional differences

To test for regional differences and to pinpoint areas of strength and ones where improvement is needed, we compared the COSEWIC statuses, SARA evaluations, and IFMP evaluations for all at-risk marine fishes between the Canadian Atlantic and Pacific ocean regions. We also present case studies in which we compare listing decisions and management for species with similar life histories: (i) seven species of rockfish (*Sebastes* spp. and *Sebastolobus* spp.) in the Pacific Ocean and (ii) three species of wolf fish (*Anarhichas* spp.) and cusk in the Atlantic Ocean. While acknowledging that the Atlantic region is actually composed of five DFO subregions (Maritimes, Gulf of St. Lawrence, Newfoundland, Quebec, and Central and Arctic), we used geographic as opposed to jurisdictional regions to elucidate broad trends. This geographic split is also necessary, as several IFMPs are used across more than one DFO region, and as such it was not possible to assess differences within or between individual Atlantic regions. The Arctic Ocean was not included, as there was overlap with the Atlantic Ocean under the Central and Arctic Region management area for relevant IFMPs.

MSC evaluation

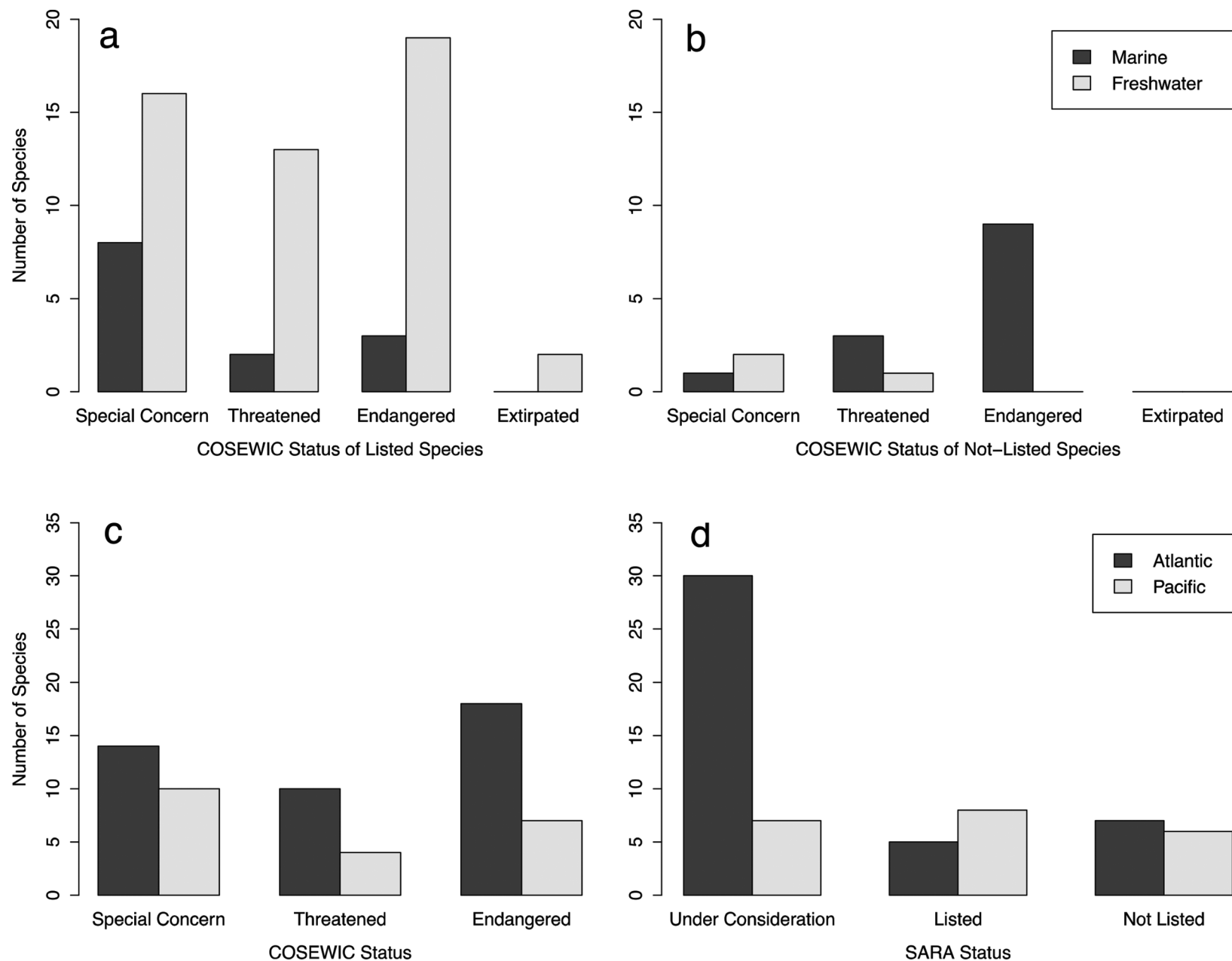
Finally, for each MSC-certified fishery, we determined how many at-risk marine fishes the fishery interacts with and how many of these species MSC considers to be ETP.

Results

SARA evaluation

Only 12 of 62 (19.3%) marine fishes assessed as being at risk by COSEWIC have been listed on SARA (Fig. 2a). The remaining species either have been denied listing ($n = 13$; Fig. 2b) or are still under consideration ($n = 37$; Figs. 2d, 3a–3c). Special Concern marine fishes, which do not require a recovery strategy or action plan, were significantly more likely to be listed on SARA than either Threatened or Endangered species (χ^2 test, $p = 0.01$); nine out of twelve Endangered species and three out of five Threatened species have been denied listing (70.6%; Figs. 2a, 2b). For example, five Special Concern rockfish species were all listed under SARA, while the two Threatened and Endangered species were denied listing, despite the fact that these species all have comparable threats, habitats, ranges, and life-history strategies, which make them susceptible to overfishing (Table S2¹). In the Atlantic, three

Fig. 2. Comparison of (a, b) the number of at-risk marine fish (dark grey) and freshwater (light grey) species in each COSEWIC threat category (Special Concern, Threatened, Endangered, and Extirpated) for which the decision was to (a) list under SARA or (b) not list under SARA; (c, d) the number of Atlantic Ocean (dark grey) and Pacific Ocean (light grey) species with each (c) COSEWIC status (Special Concern, Threatened, Endangered) and (d) SARA status (Under Consideration, Listed, Not Listed).



wolffish species were automatically listed when SARA was proclaimed in June 2003 (Government of Canada 2008), whereas cusk, a species assessed by COSEWIC as Endangered and with similar characteristics and justifications for its COSEWIC designation as the wolffish, was later denied listing (Table S2¹). Overall, compared with the Pacific Ocean ($n = 21$), there are many more at-risk species in the Atlantic ($n = 42$), almost half of which are Endangered ($n = 18$; Fig. 2c). Despite this, fewer Atlantic species have been listed on SARA, and more have been denied listing or are still under consideration in comparison with Pacific species (Fig. 2d). Finally, in contrast with marine fishes, almost two-thirds ($n = 50$ of 77) of at-risk freshwater fishes have been listed under SARA, including all Endangered and all but one Threatened species (Figs. 2a, 2b); only three species have been denied listing (Fig. 2b).

Although marine fishes move through the SARA process slowly, their pace is not significantly slower than that of freshwater fishes (two-sample t test, two-way ANOVA, two-sample t test; Figs. 3a, 3d, 3g). The 37 marine fish species still under consideration for SARA listing have spent an average of 3.25 years waiting for a decision, to date (Fig. 3a); their time under consideration is not significantly influenced by either COSEWIC status (one-way ANOVA; Fig. 3b) or region (two-sample t test; Fig. 3c). Of those species with a SARA decision, decisions were made significantly more quickly for listed than not-listed species, whether marine or freshwater (two-way ANOVA, $p = 0.01$; Fig. 3d), and for marine fishes in the Pacific than Atlantic (two-sample t test, $p = 0.01$; Fig. 3f). For marine fishes, although there is a tendency for decision times to take longer for Threatened and Endangered species, this difference is not statistically significant (one-way ANOVA; Fig. 3e). Once listed on SARA, measures were not typically created on time for either marine or freshwater species (two-sample t test; Fig. 3g). For marine fishes, SARA measures were on average completed on time for Special Concern species and species in the Pacific, but not for Threatened or Endangered species (one-way ANOVA; Fig. 3h) or those in the Atlantic (two-sample t test, $p = 0.02$; Fig. 3i). For example, final measures, which are to be produced within 90 days, took on average 243.5 days for Threatened and Endangered species and 292.7 days for Atlantic species.

Overall, once a marine fish is assessed as being at risk by COSEWIC, it takes an average of 4.77 years to receive a final SARA measure, if it is SARA listed, and an average of 4.34 years to be denied SARA listing (such that its conservation is in the hands of DFO). Notably, bocaccio (*Sebastes paucispinis*) and cusk, both of which are Endangered, waited 8.60 and 9.83 years, respectively, before being denied listing.

IFMP evaluation

SARA and Fisheries Act equivalencies

Many elements of SARA recovery strategies and action plans are included as a part of the IFMP template and SFF policy suite (Table 1). The IFMP template includes provisions for short- and long-term stock status objectives, which could be considered as a proxy for timelines in SARA recovery strategies. Required performance reviews under the IFMP template could include progress on achieving recovery for listed and not-listed species. The IFMP template and SFF policy suite do not, however, include measures equivalent to the SARA recovery strategy measure to “identify information gaps that should be addressed” and do not have set rebuilding timelines and targets. Habitat considerations are included in IFMPs and are included in the SBA policy as well as the Ecological Risk Assessment Framework for Coral and Sponge Dominated Communities policy, but there is currently no habitat protection for at-risk pelagic or semipelagic species.

IFMP-at-risk species interactions

IFMPs included significantly more conservation measures for listed than not-listed species (two-sample t test; $p < 0.01$; Fig. 3j). An exception, however, among the not-listed species is the rockfish bo-

caccio in the Pacific, which receives a higher amount of protection than any of the listed species (Table S2¹). Overall, four measures — harvest control, bycatch mitigation, closed areas, and reference to the SBA policy — were included for most IFMP-at-risk species interactions, regardless of whether the species were listed or not (Fig. 4a). In contrast, the bycatch policy, SBA protection measures, and habitat protection were less frequently included and generally only for listed species (Fig. 4a). Finally, there are no precautionary reference points in any IFMPs for SARA-listed species and only one for a not-listed species (Fig. 4a), those for bocaccio on the west coast.

IFMPs included a significantly higher proportion of the conservation measures for Special Concern than for Threatened or Endangered species (one-way ANOVA, $p = 0.01$, $p < 0.01$; Fig. 3k) and for Pacific than Atlantic species (two-sample t test, $p < 0.01$; Fig. 3l). Pacific rockfish and cusk-wolffish in the Atlantic are illustrative of these geographic management discrepancies; the former species had between 75% and 87.5% of conservation measures in their IFMPs, while the latter had only between 52.5% and 54.2% (Table S2¹). Overall, the bycatch policy and habitat protection were seldom implemented for Threatened or Endangered species (Fig. 4b) or those in the Atlantic (Fig. 4c). The differences in habitat protection reflect the existence of the Rockfish Conservation Areas on the west coast. For IFMP-at-risk species interactions in the Atlantic, there is no habitat protection (Fig. 4c), regardless of SARA status. This is not surprising for not-listed species, because this is not required under the Fisheries Act, and these species have not had their critical habitat identified under SARA. However, even those listed species with critical habitat identified in their SARA recovery strategy (i.e., three species of wolffish and Atlantic salmon (*Salmo salar*; Inner Bay of Fundy population)) do not have habitat protection in the IFMPs with which they interact. These species have fallen through a loophole; despite the SARA requirements, the Fisheries Act only requires habitat protection for commercially harvested species, and none of these species is currently subject to a commercial fishery. Finally, with respect to the other measures, inclusion and implementation of the SBA policy was generally higher in the Pacific than Atlantic region (Fig. 4c), and harvest control was the only measure more commonly included for Atlantic than Pacific species (Fig. 4c).

MSC-certified fisheries

Twenty fisheries in Canada are currently MSC-certified; one of these is for an at-risk species, sockeye salmon (*Oncorhynchus nerka*; Table S3¹). Although these 20 fisheries interact with a total of 23 COSEWIC assessed at-risk marine fish species, MSC only considers five of these species to be ETP species. As such, when MSC evaluated these fisheries for certification, management measures did not need to exist for the other 18 at-risk marine fishes, even if they were considered an Endangered species by COSEWIC.

Discussion

Bias in SARA listing decisions

Our analysis underscores the ongoing bias against listing at-risk marine fishes under SARA, previously documented by Mooers et al. (2007), Findlay et al. (2009), Schultz et al. (2013), and others (Table S1¹). We also explore the worrying trend that those species most in need of conservation — namely those assessed as Threatened or Endangered — are least likely to be listed. Whereas SARA listings for marine fishes in these higher risk categories trigger basic prohibitions that cause their commercial harvest to cease, except by allowable harm permit, such prohibitions do not apply to Special Concern species. Decisions to list Threatened and Endangered marine fishes that are threatened primarily by fishing can thus be highly political owing to conflict with commercial interests, and these species tend to be denied listing to protect their associated socio-economic value (Mooers et al. 2007; Findlay et al. 2009; Prugh et al. 2010; McCune et al. 2013). Rockfish on

Fig. 3. Boxplots comparing (a, b, c) the number of years that species still under consideration for SARA have been waiting for (a) marine versus freshwater fishes, (b) marine fishes with different COSEWIC at-risk statuses (Special Concern (SC), Threatened (TR), or Endangered (EN)), and (c) marine fishes in the Atlantic versus Pacific oceans; (d, e, f) the number of years from the COSEWIC assessment to a published SARA listing decision for (d) listed (L) versus not-listed (NL) marine (M) and freshwater (FW) species, (e) marine fishes with different COSEWIC at-risk statuses, and (f) marine fishes in the Atlantic versus Pacific oceans; (g, h, i) the lateness (time taken/time allowed) of proposed and final SARA measures for (g) marine versus freshwater fishes, (h) marine fishes with different COSEWIC at-risk statuses, and (i) marine fishes in the Atlantic versus Pacific oceans. The horizontal red line indicates when a measure would be completed on time, with anything above the line being late; (j, k, l) the percentage of Fisheries Act measures included in each IFMP-at-risk species interaction (listed or not listed on SARA) for marine fishes (j) that were SARA-listed versus not listed, (k) with different COSEWIC at-risk statuses, and (l) in the Atlantic versus Pacific oceans. For each plot, the sample size in each category is shown in parentheses.

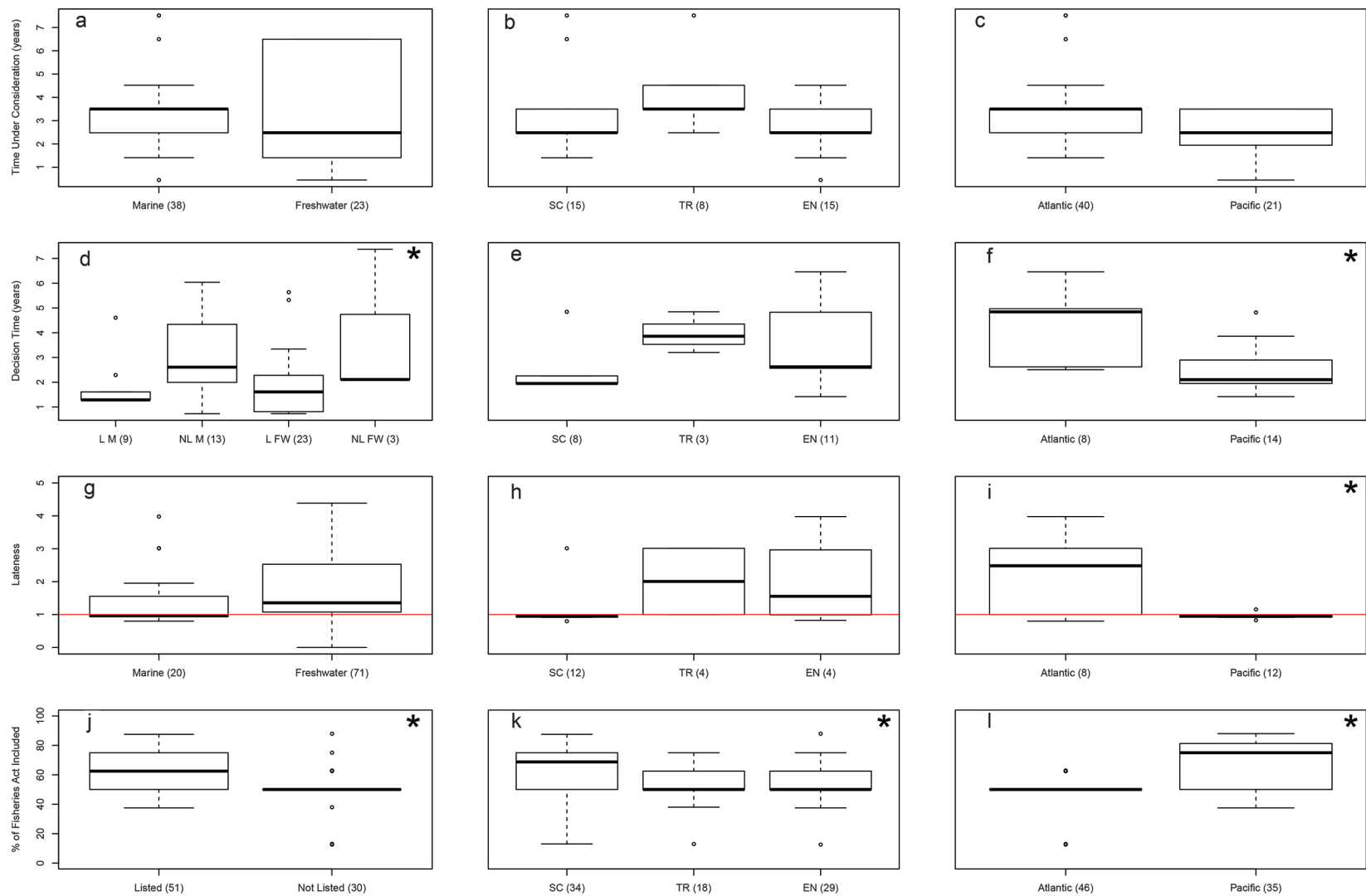


Table 1. A comparison of Species at Risk Act (SARA) measures (recovery strategies versus action plans), Sustainable Fisheries Framework (SFF) policies, and Integrated Fisheries Management Plan (IFMP) templates in their measures relating to conservation of species at risk.

	IFMP template elements	SFF policies
Recovery strategy measures		
Describe the particular species and its needs	Yes: Section 3.1 outlines fishery; Section 3.2 stock assessment	—
Identify threats to survival	Yes: Section 3.4 to include depleted species concerns, oceans and habitat considerations, and gear impacts	Yes ^{a,b,c,d}
Classify the species' critical habitat, where possible	Yes: Section 3.4 to include habitat considerations; Section 3.7 to include SARA requirements and habitat consideration measures	Yes ^{b,c}
Provide examples of activities that are likely to result in destruction of the critical habitat	Yes: Section 3.4 to include habitat considerations; Section 3.7 to include SARA requirements and habitat consideration measures	Yes ^{b,c}
Set goals, objectives, and approaches for species recovery with set timelines	Somewhat: Can include short- and long-term sustainable fisheries objectives for stock conservation (Section 3.7 includes SARA measures), but has no targets or timelines to rebuilding not-listed species at risk	Yes ^a
Identify information gaps that should be addressed	No specific requirement, but could be included under IFMP enhancement section	No specific requirement
State when one or more action plans relating to the strategy will be completed	Yes: Section 3.10 to include performance review; IFMPs now “evergreen” with appendices to be updated	No specific requirement
Action plan measures		
Identification of the species' critical habitat (unless it is not possible to do so) and examples of activities that are likely to affect it	Yes: Section 3.4 to include depleted species concerns, oceans and habitat considerations, and gear impacts; Sensitive Benthic Areas (SBA) closures and spawning ground closures	Yes ^{b,c}
Proposed measures for protecting the critical habitat	Yes: Section 3.4 to include depleted species concerns, oceans and habitat considerations, and gear impacts; SFF's SBA closures and spawning ground closures	Yes ^{b,c}
An identification of any portions of the critical habitat that have not been protected	Yes: Section 3.4 to include depleted species concerns, and oceans and habitat considerations, and gear impacts	Yes ^{b,c}
A statement of the steps for implementing the recovery strategy and when they are to take place	Somewhat: Section 3.7 includes SARA measures; Section 3.10 includes performance review; no timelines or targets in IFMPs	No specific requirement
An evaluation of the socio-economic costs of the action plan and any implementation benefits	Yes: Section 3.3 includes socio-economic information including economics of the specific fishery, socio-economic profile, and market trends	No specific requirement

^aGuidance for the Development of Rebuilding Plans under the Precautionary Approach Framework: Growing Species out of the Critical Zone (April 2013).

^bPolicy for Managing the Impact of Fishing on Sensitive Benthic Areas (April 2009).

^cEcological Risk Assessment Framework for Coral and Sponge Dominated Communities (April 2013).

^dPolicy on Managing Bycatch (April 2013).

Canada's west coast underscore this bias; all Special Concern species were listed on SARA, while the Threatened and Endangered ones were rejected (Table S2¹). Rockfish are an integral component of Canada's Pacific groundfish fisheries (Fisheries and Oceans Canada 2014b), and listing Threatened or Endangered rockfish under SARA would have restricted these fisheries. Somewhat paradoxically, in this case ENGOs (i.e., environmental nongovernmental organizations) did not support SARA listing these species because equivalent conservation measures, including bycatch limits and Rockfish Conservation Areas (RCAs), were already in place through IFMPs. Unfortunately, however, there is little enforcement by DFO for these measures, so it is difficult to assess their effectiveness.

To overcome the general listing bias against Threatened and Endangered marine fishes, we recommend the SARA listing process include independent, peer-reviewed, long-term economic analyses so that decisions regarding management measures can be made with overall population rebuilding in mind, rather than based on short-term economic losses (Mooers et al. 2010; Schultz et al. 2013). Additionally, there is a need to more directly involve Species at Risk staff on scientific advisory committees within DFO to streamline the conservation process and ensure that population recovery measures are implemented as a coordinated effort, rather than the SARA listing being seen as an impediment to resource management (Table 2). Finally, clear delisting criteria

need to be developed such that marine fishes that have recovered sufficiently can be removed from SARA pending demonstration of sufficient management measures under the Fisheries Act to avoid subsequent overfishing (Table 2).

Bias and delays in the SARA process

We find that apart from the listing bias, the remainder of the SARA process is not biased against marine fishes per se, but rather because some steps in the process do not have legislated timelines, it is slow for marine and freshwater species (Figs. 3a, 3d, 3g). Many at-risk species appear to be stuck in the SARA consultation period, in limbo for years without a decision. Lake sturgeon (*Acipenser fulvescens*) exemplifies this problem; the eight subpopulations of this freshwater species have been under consideration for 6.5 years (Fig. 3a) and historically supported a large commercial fishery (COSEWIC 2006), suggesting that as with other species (Mooers et al. 2007; Findlay et al. 2009), their economic value is delaying a SARA decision. Given that at-risk marine and freshwater species spend an average of 3.33 years in the SARA listing process and typically receive no additional protection through fisheries management during this time, it is not surprising that some species have moved into higher risk categories while awaiting a SARA decision (e.g., both striped bass (*Morone saxatilis*; Bay of Fundy population, freshwater fish) and Atlantic cod (Northern Laurentian population, marine fish) were uplisted from Threatened

Fig. 4. For each of eight Fisheries Act conservation measures, the percentage of IFMP-at-risk species interactions that include the measure is compared across at-risk marine species by (a) SARA status, (b) COSEWIC status (SC, Special Concern; TR, Threatened; EN, Endangered), and (c) region.

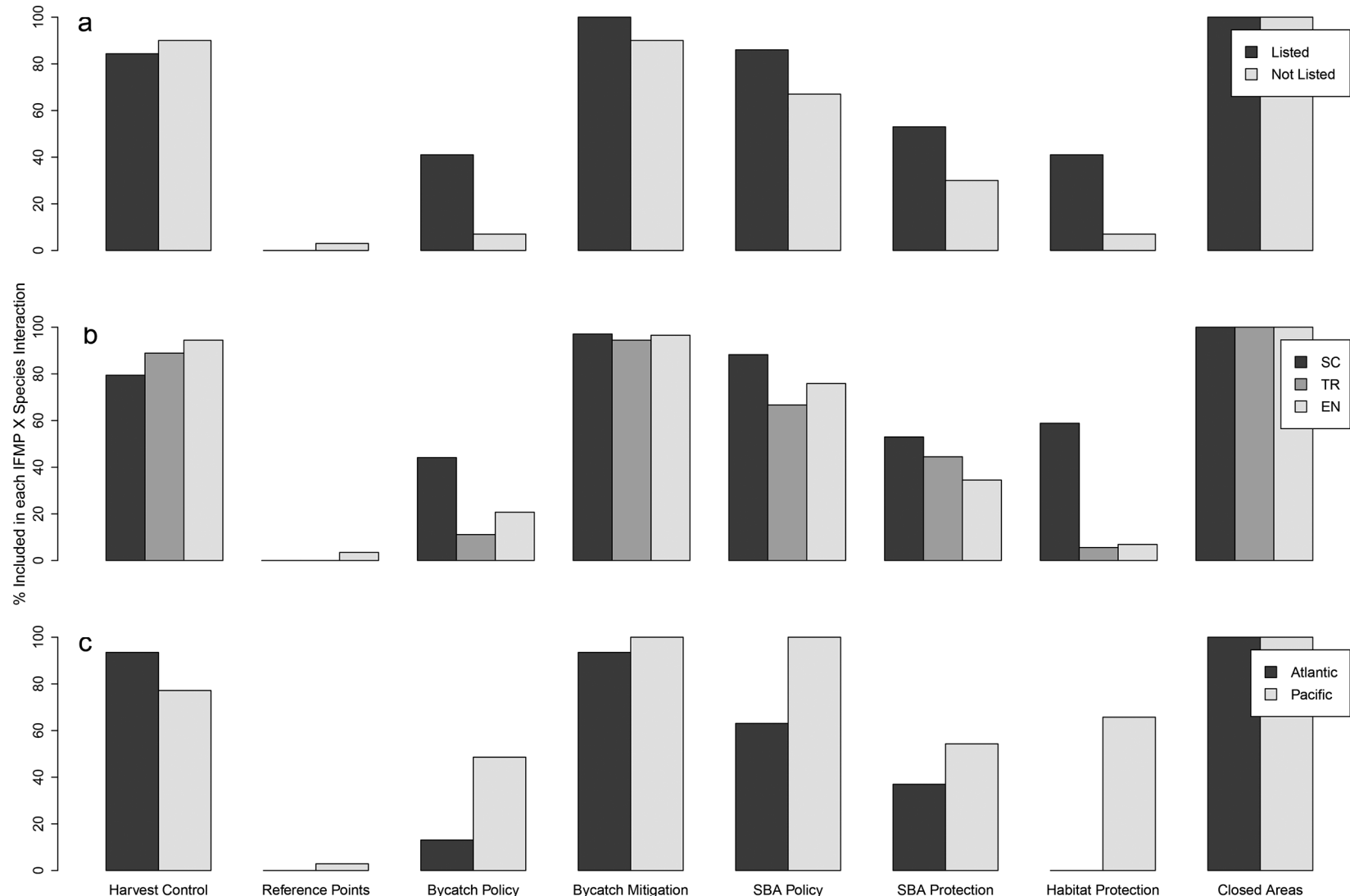


Table 2. Proposed management actions that would contribute to the recovery of marine fish species deemed to be at risk by COSEWIC.

We recommend that SARA:

- I. Set and adhere to strict timelines when species are under consideration for listing to avoid delays in listing decisions
- II. Adhere to its own mandated timelines for implementing SARA measures, including the development of proposed and final management plans and recovery strategies, as well as the development and implementation of action plans
- III. Undertake independent, peer-reviewed, long-term economic analyses as part of the listing process to avoid decisions based on short-term losses
- IV. Ensure the direct involvement of SAR staff within DFO with resource management processes to ensure that effective measures are identified for population rebuilding of marine species at risk
- V. Develop criteria under which delisting of SARA-listed species would occur
- VI. Consider the application of SARA Conservation Agreements (Section 11) to marine species at risk, engaging resource users in a combination of efforts including but not limited to public education, habitat protection, and population monitoring

Upon publication of the COSEWIC assessment, we recommend DFO:

- I. Determine and implement effective management measures, either through SARA or the Fisheries Act, that will lead to population recovery, prior to a decision being made regarding listing or not listing on SARA

If a species is under consideration or not listed under SARA, but is assessed by COSEWIC as Threatened or Endangered and is impacted by a commercial fishery, we recommend DFO:

- I. Develop a suite of management measures to be included in IFMPs that should lead to population recovery of marine species at risk
- II. Determine species-at-risk quota and precautionary reference points based on progress made on rebuilding stocks
- III. Ensure that IFMPs consistently include both the bycatch and SBA policies and associated management measures including timelines and targets for implementation of such measures
- IV. Use the habitat protection provisions of the Fisheries Act to identify critical fish habitat and include its protection under IFMPs, including spatial and temporal closed areas and gear restrictions, based on threats identified in COSEWIC assessments
- V. Conduct regular and transparent assessments of progress toward stock rebuilding to hold managers accountable, including the identification of priorities for recovery and rebuilding of marine fish populations
- VI. Develop effective collaborations between fisheries managers and species-at-risk staff within DFO with both fishing industry and nongovernment stakeholders to achieve comprehensive management measures

We recommend third-party eco-certification schemes, and the Marine Stewardship Council (MSC) in particular:

- I. Ensure that certification criteria adhere to best practices identified in both national and international policy, particularly with regards to addressing bycatch and habitat protection concerns
- II. Ensure that MSC conditions include not-listed species at risk, particularly those listed by COSEWIC as Threatened or Endangered. Conditions should be required and applied to meet species recovery targets and timelines; otherwise, certification certificates should be revoked

to Endangered (Government of Canada 2014). New COSEWIC assessments — which are required every 10 years or earlier if there is a suspected change in species status — trigger an entirely new listing process, which further prolongs listing decisions. The lack of deadlines in the SARA listing process is a serious weakness of the Act and contrasts with the United States Endangered Species Act (ESA), which has strict deadlines throughout its listing process (Waples et al. 2013). SARA's ineffectiveness is underscored by the recent finding that the probability of recovery for at-risk species in Canada was not related to the length of time they had been SARA-listed (Favaro et al. 2014).

An additional bias within the SARA listing process is in the decision times, with these taking significantly longer for species denied listing, whether marine or freshwater (Fig. 3d). This bias also appears to stem from the economic value of fisheries associated with these species (Schultz et al. 2013), which results in opposition to listing from fishing industry stakeholders and a prolonged decision process. For example, the recent public consultation period for listing Atlantic cod, redfish (*Sebastes* spp.), and American plaice (*Hippoglossoides platessoides*) was extended several times. Moreover, because listings for Endangered and Threatened marine fishes are controversial, there is a tendency for their decisions to take longer than those of Special Concern (Fig. 3e); given the greater number of these species in the Atlantic, this translates into longer decision times in that region (Fig. 3f).

At-risk species are further imperiled by the slow SARA listing process because there are no requirements for them to be given special management considerations while they are under consideration. This is particularly relevant for marine fishes, where the decision to not list takes an average of 4.34 years, fishing is often the greatest threat to recovery, and there exists a comprehensive management framework within which such measures could be

put in place. DFO's SFF includes "A Fishery Decision-Making Framework Incorporating the Precautionary Approach", which requires that stocks in the "critical zone" be managed consistently with recovery objectives (Fisheries and Oceans Canada 2009b), yet many stocks lack actual recovery objectives, reference points, or rebuilding plans. Atlantic bluefin tuna (*Thunnus thynnus*), a species assessed by COSEWIC in 2011 as Endangered (COSEWIC 2011), is illustrative of a commercially valuable marine fish that the SARA process is failing. In the 3 years that this species has been under consideration for SARA, it has received no new protective measures or management plans from DFO. Indeed, the IFMP for Atlantic bluefin tuna is not publicly available and according to DFO has not been updated since 2008. Most egregiously, Canada agreed to a quota increase at the 2014 ICCAT (International Commission for the Conservation of Atlantic Tunas, the international body that sets harvest rates for tuna) meetings, despite the fact that fishing mortality is the main threat to the species. To ensure that fisheries management measures do not contradict the intentions of the listing process, we recommend that upon at-risk designation, measures immediately be put in place through IFMPs, and fisheries license conditions and assessment of the most appropriate tool for population rebuilding be completed to remove agency and industry bias against listing (Table 2).

Once marine fishes are listed under SARA, the implementation of its measures does not appear to be biased against them, but rather measures for both marine and freshwater fishes are generally late (Fig. 3g). Our findings build upon Mooers et al.'s (2010) analysis, which showed that across all taxa, final recovery strategies had not been developed for many species, but did not quantify the timelines. McCune et al.'s (2013) study suggests that the lack of finalized recovery strategies is exacerbated for species threatened with biological resource use (i.e., hunting and trap-

ping terrestrial animals, gathering terrestrial plants, logging, fishing and harvesting aquatic resources, historical harvest–fishing, bycatch) regardless of their taxa or habitat. A likely reason for this is that recovery strategies will usually limit harvest of at-risk species, and hence their development may be controversial. In our analysis, both proposed and final recovery strategies for Threatened and Endangered marine fishes took almost double the legislated time before they were finalized (Fig. 3h). As these species are at higher risk of extinction than Special Concern species, associated SARA measures must be developed more quickly (Table 2). Prompt development of recovery plans within the ESA has resulted in an increased proportion of US species with upward population trends (Taylor et al. 2005). In contrast, recovery of Canada's at-risk marine fish species is impeded not only by late recovery strategies, but also because no action plans have yet been developed. For listed species, DFO should consider working with resource users to develop Conservation Agreements through Section 11 of SARA. To date, no such agreements exist for marine species, although on land they are in place for at least the sage grouse (*Centrocercus urophasianus*) and its related critical habitat protection (Table 2). Marine fish species threatened by fishing typically have high recovery potential, but this is contingent upon swift and decisive management action (Neubauer et al. 2013). Delaying the adoption of conservation measures for at-risk marine fishes not only delays recovery, but makes the recovery process less certain (Neubauer et al. 2013) and may also decrease cumulative yields (Schertzer and Prager 2007), thus harming fisheries in the long run.

Alternative conservation measures for not listed at-risk marine fishes?

Although the IFMP template and SFF policies include many conservation measures comparable to SARA, which suggests that the Fisheries Act has the potential to serve as an effective alternative to SARA, they fall short in three key respects (Table 1). First, while listed species are required to have recovery targets and timelines under SARA, the IFMPs have no such requirement. Arguably, the Rebuilding Policy under the SFF (Fisheries and Oceans Canada 2013c) could be used to create targets and timelines for species recovery; however, there is no public information documenting the application of this policy to any not-listed marine fishes. The sole exception is the Rebuilding Plan released in spring 2015 for 3Ps cod (a subpopulation of the endangered Laurentian North designated unit), which was completed as part of a Fisheries Improvement Plan developed in part with the goal of obtaining MSC certification (Marine Stewardship Council 2014). Second, the conservation policies do not have a measure comparable to SARA's measure to "identify information gaps that should be addressed" for not-listed at-risk species, such that DFO managers are not required to fill key life-history or habitat requirement gaps for these species. Third, the only policies relating to habitat protection are the SBA policy and the Ecological Risk Assessment Framework for Coldwater Corals and Sponges, which focus only on protecting sensitive coral and sponge benthic communities. It remains uncertain to what extent these closures provide refuge for at-risk demersal or pelagic marine fishes. Finally, there are no additional habitat protection measures in place for these species.

Even where there are measures comparable to SARA, they are inconsistently applied in the actual IFMPs. For example, while IFMPs are supposed to contain all the measures laid out in the SFF, across all species, they had high inclusion only of harvest control, bycatch mitigation, closed areas, and reference to the SBA policy. Our assessment may be overly optimistic, since we considered measures to be included in a given IFMP-at-risk species interaction if there were any provisions for it (e.g., unspecified bycatch limit; Table S4¹). Furthermore, inclusion of conservation measures within IFMPs does not assume these measures are actually implemented, enforced, or assessed for effectiveness.

Not-listed species had significantly fewer conservation measures included in IFMPs and thus are not receiving adequate protection under the Fisheries Act. As there is a bias against listing Threatened and Endangered marine fishes, it is these species that receive significantly fewer conservation measures in IFMPs than Special Concern species; the majority of these species are in the Atlantic. Accordingly, many COSEWIC reassessments for not-listed species show a lack of recovery (e.g., Atlantic cod (COSEWIC 2010) and porbeagle shark (*Lamna nasus*) (Simpson and Miri 2014)). An exception to fewer conservation measures for not-listed species is bocaccio, a not-listed Pacific rockfish that has the highest inclusion of Fisheries Act measures (~87%) for any at-risk marine fish. Bocaccio management is a positive example of DFO implementing alternative conservation measures to SARA and one that should be emulated in future management of not-listed marine fishes.

Of the conservation measures we assessed, harvest control has been implemented for most at-risk marine fishes, but only bocaccio had precautionary reference points in the IFMP (Fig. 4); in the Pacific, coho (*Oncorhynchus kisutch*) and sockeye salmon are managed through an abundance-based framework, which is essentially equivalent to the Precautionary Approach Framework. Failure to develop almost any reference points for at-risk species is a major barrier for effectively conserving marine fishes and one that is likely to persist given the move to multiyear stock assessments (Fisheries and Oceans Canada 2012), which will further delay their development.

There also was inconsistent inclusion and implementation of both the bycatch policy and the SBA policy in IFMPs. On a positive note, almost all at-risk species were subject to some bycatch mitigation measures through fleet-wide quota and percentage of daily catch restrictions. In some cases, vessels that exceeded bycatch limits were also required to move a specific distance away from their initial fishing area. Yet despite reference to these bycatch measures in the IFMPs, most IFMPs failed to reference the 2013 bycatch policy, which aims to reduce the impacts of bycatch across fisheries. Because this policy is new, lack of reference to it partly reflects outdated IFMPs. In contrast, most IFMPs referenced the SBA policy but had not implemented any SBA closures. We recommend that DFO regularly update IFMPs with new policies, both by referencing them and, importantly, by implementing the associated management measure. Systematic inclusion of these policies within IFMPs would help ensure that related measures are included and enforced, minimize variability in the implementation of measures among resource managers, and contribute to transparency and accountability across DFO regions (Table 2).

Of the two remaining conservation measures, almost all IFMP-at-risk species interactions included closed areas, whereas few had habitat protection (Fig. 4). However, closed areas, including marine protected areas (MPAs) such as The Gully on Canada's east coast, were rarely created for the purpose of protecting at-risk species. Thus, while IFMPs may refer to closed areas, seldom do the MPA management plans include species-specific habitat protection in their objectives, and their effectiveness could be marginal (Fisheries and Oceans Canada 2014c). Similarly, there is no evaluation within IFMPs as to whether existing time-area closures, to protect target species' spawning grounds, benefit at-risk species. With respect to habitat protection, even listed species with critical habitat identified in their SARA recovery strategy do not have habitat protection within IFMPs. The sole exception to this was the creation of RCAs through the Pacific Groundfish IFMP, which should benefit both listed and not-listed rockfish species. We recommend that DFO build upon this example by implementing species-specific habitat protection for at-risk marine fishes (after first identifying critical habitat for not-listed species and including previously identified habitat for listed species in the IFMPs; Table 2) and emphasize that monitoring and enforcement of these closures also are key. In the absence of such measures, Canada's weak aquatic habitat protection (e.g., Favaro

et al. 2012) will continue to hinder the conservation of at-risk fishes (Quigley and Harper 2006).

Protecting critical fish habitat is linked to productive and sustainable fish populations (Naiman and Latterall 2005), but under the Fisheries Act fishing habitat loss is not considered a threat to fishes. Even though the Act was updated in 2012, protection from fishing on fish habitat is still not included; the Act only says it will focus on managing threats for sustainable and productive fisheries (Fisheries and Oceans Canada 2014d). In comparison, the US Magnuson–Stevens Act requires the identification of Essential Fish Habitat (EFH), defined as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity”, and mandates the regional Councils to identify, describe, map, and protect EFH (Department of Commerce 2007). Canadian fisheries management should consider aligning its habitat protection requirements with the Magnuson–Stevens Act to provide stronger protection that will lead to more sustainable and productive fisheries, particularly where there are shared stocks.

On a general note, Pacific region IFMPs were promptly available when requested and up to date, whereas Atlantic DFO regions would not readily release all of their IFMPs or the new versions of their IFMPs. As the Atlantic region is divided into several DFO subregions, it also was a challenge to locate all of the required information, as there is no central publicly available IFMP repository. Interestingly, we also observed a cultural difference between the regions; Pacific region staff seemed more open and cooperative in processing our information requests and responded in a timely manner.

Encouragingly, in September 2014, DFO published a “Do Not List” directive as part of its SARA listing policy framework, which lays out its Default Listing Position. This directive was developed partially to standardize SARA listing decisions for at-risk marine species across DFO regions and states that DFO must advise that all at-risk marine species be listed unless a compelling rationale can be provided to support a decision not to list the species (Fisheries and Oceans Canada 2014e). The directive lays out a series of conservation measures, including performance indicators for evaluation of success that must be in place for the at-risk species before DFO could recommend that it not be listed. It remains to be seen whether this directive will result in species being recommended for listing that otherwise may not have been as a result of socio-economic concerns at the regional level.

MSC-certified fisheries

Most at-risk marine fishes that interact with Canada’s MSC-certified fisheries are not recognized by MSC as ETP species because they are not SARA-listed, and as such they do not receive additional conservation measures after certification (Table S3¹). Instead, MSC relies on Fisheries Act measures, even though most of these have not been implemented. MSC certifications have thus been controversial within Canada, the most recent example being the Canadian Atlantic pelagic longline swordfish fishery, which has high bycatch rates of at-risk sea turtle and shark species that are not SARA-listed. Despite a formal objection, the fishery was MSC-certified (Jacquet et al. 2010). More generally, the MSC has been criticized for failing to address issues such as overfishing and biodiversity loss in our oceans (Ward 2008; Jacquet et al. 2010). Meanwhile, DFO managers often point to MSC-certified fisheries as evidence of “best practices” in Canadian fisheries, despite there being no evidence that MSC certification leads to improved conservation for Canadian species at risk. Third-party eco-certification schemes, and MSC in particular, have a responsibility to ensure certified fisheries are not endangering species at risk. Moving forward, we recommend that MSC consider all Canadian at-risk marine fishes as ETP, regardless of whether they have been SARA-listed or not (Table 2).

Synthesis and future directions

Marine fishes in Canada are missing the safety net that is meant to be provided by SARA or the Fisheries Act. Both Acts have the potential to effectively conserve at-risk marine fishes, but neither act is currently being implemented adequately to do so, and arguably well-meaning legislation and related regulatory frameworks are failing. Our analysis reveals that in addition to the well-known bias against listing marine fishes on SARA, for those species that do get listed, it takes years (mean = 4.8) before they receive final management plans or recovery strategies, and it is unclear if they ever receive effective conservation measures, as no Action Plans have ever been finalized for a listed marine fish. Our analysis also demonstrates that Threatened and Endangered marine fishes, which are in the most need of conservation measures, fare the worst under both Acts. Not only do these species face a bias against SARA listing, but during their prolonged consideration time for SARA, they receive no new conservation measures under the Fisheries Act, indicating a troubling lack of responsiveness from DFO. After being denied listing, these at-risk species still do not receive adequate conservation measures under the IFMPs, due to lack of SFF implementation, and instead often continue to face heavy fishing pressure. Thus, while the existence of management measures and policy frameworks under the Fisheries Act has been used as a reason for not listing marine fishes under SARA, our analysis reveals that implementation of these measures for at-risk marine fishes is inadequate to ensure their recovery. Moving forward, SARA and Fisheries Act measures need to be fully implemented for at-risk marine fishes in faster, legally binding timeframes, and the efficacy of these measures at promoting recovery must be regularly evaluated. As fishing remains the greatest threat to most marine fishes, fisheries management measures that effectively reduce fishing mortality and protect habitat of at-risk marine species, coupled with binding timelines and targets for population rebuilding, are needed to move toward species recovery.

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