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Using Red List Indices to monitor extinction risk at national scales

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Abstract

The Red List Index (RLI) measures change in the aggregate extinction risk of species. It is a key indicator for tracking progress toward nine of the Aichi and many proposed post-2020 Global Biodiversity Framework Targets. Here, we consider two formulations of the RLI used for reporting biodiversity trends at national scales. Disaggregated global RLIs measure changing national contributions to global extinction risk and are currently based on five taxonomic groups, while national RLIs measure changing national extinction risk and are based on taxonomic groups assessed multiple times in country. For 74% of nations, the disaggregated global RLI is currently based on three or fewer taxonomic groups. Meanwhile, national RLIs from selected pilot countries Finland, South Africa, and Brazil are computed from twelve, eight, and nine taxonomic groups, respectively. The national RLI and the disaggregated global RLI measure different aspects of biodiversity, in that the former detects national trends in populations of species for which each country is responsible while the latter provides standardized comparisons of nations' contributions to the global extinction risk of the same species groups. As governments commit to the

post-2020 Global Biodiversity Framework, we encourage them to monitor a standard set of taxonomic groups representing different biomes using both RLI formulations to ensure effective target tracking and accurate feedback on their conservation investments.

KEYWORDS

disaggregated global Red List Index, indicators, national Red List Index, species monitoring

1 | INTRODUCTION

Globally, biodiversity is declining at unprecedented rates, with assessments showing weak progress against the Convention on Biological Diversity's (CBD) Aichi Targets to prevent loss (CBD, 2020a; IPBES, 2019). The IUCN Red List of Threatened Species (hereafter, "IUCN Red List") is the most important source of information for monitoring the status of species and for informing conservation actions (Brooks et al., 2015; Rodrigues et al., 2006). The Red List Index (RLI) is a metric derived from the IUCN Red List to indicate trends in the status of biodiversity, using changes to species' extinction risk categories (Brooks & Kennedy, 2004; Butchart et al., 2005, 2007). The RLI can be calculated for any set of species that has been assessed for the Red List at least twice. An aggregated index is produced by combining and equally weighting individual taxonomic group RLIs (Butchart et al., 2010). The global RLI, which currently includes mammals, birds, amphibians, corals, and cycads, has been a key indicator used for reporting against Aichi Target 12 (on preventing extinctions and conserving species) and contributed to reporting against a further eight targets (CBD, 2020a). The global RLI is also used to assess progress toward the United Nations Sustainable Development Goal (SDG) 15 (Life on Land) (UN, 2022), in several other policy fora (including the Convention to Combat Desertification, Convention on Migratory Species and the Ramsar Convention), and in global assessments of the state of nature (CBD, 2020a; IPBES, 2019; UN Environment, 2019).

Parties to the CBD are responsible for developing National Biodiversity Strategies and Action Plans, monitoring their own progress toward agreed biodiversity targets and summarizing results in national reports to the CBD approximately every 4 years. Inclusion of robust, globally consistent indicators in these national plans and reports is fundamentally important in ensuring that national resources are targeted in the most effective way. Moreover, this also has implications for the targeting of global resources, for example, through the System of Transparent Allocation of Resources of the Global Environment Facility (gef, 2018), which is in turn heavily influenced by the IUCN Red List in channeling funding toward the greatest incremental global benefit.

Nations have two ways to produce RLIs, which, respectively, track their country's contributions toward reducing global and national extinction risk. The first method, which we refer to as the "disaggregated global RLI," uses existing IUCN Red List assessments for global extinction risk of each species, and adjusts each species' contribution to the national index by weighting it by the fraction of the species' distribution occurring within the country (UNSD, 2020) (Figure 1). Disaggregated global RLIs for each country are provided on the IUCN Red List website (https://www.iucnredlist.org/search), the Biodiversity Indicators Dashboard (https://bipdashboard.natureserve.org/), the Integrated Biodiversity Assessment Tool (https://www.ibat-alliance.org/country_profiles), and on the United Nations SDGs indicators database (https://unstats.un.org/sdgs/indicators/database/). The second option is to assess national extinction risk for the proportion of species' populations occurring within their boundaries by applying the Guidelines for Application of the IUCN Criteria at Regional and National Levels (Brito et al., 2010; IUCN, 2012; Zamin et al., 2010) (Figure 1). Repeated assessments are needed for all species within each selected taxonomic group, and a combined RLI, here referred to as a "national RLI," can then be produced (Bubb et al., 2009). Broadly, greater similarity between the two metrics is expected for countries with a higher proportion of endemic species (Figure 1), while the metrics will differ to varying degrees for countries that share their species with others.

The two RLI approaches produce indicators that measure different aspects of biodiversity. The national RLI shows trends in national level extinction risk for the species groups included, whereas the disaggregated global RLI shows national contributions toward global extinction risk trends (Rodrigues et al., 2014). For countries with a small proportion of a species' range, any efforts to conserve the species will only have a minor impact on the global extinction risk of the species and negligibly affect the disaggregated country-level global RLI value (Figure 1, species A, B). Similarly, the global RLI will be affected only slightly by severe national deterioration for

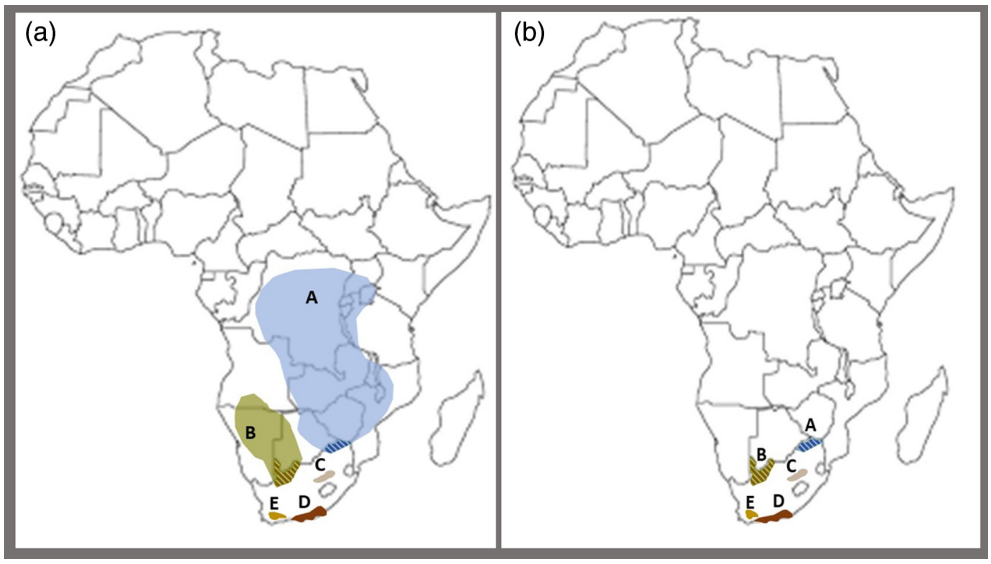

FIGURE 1 Comparison of disaggregated global and national Red List Indices (RLIs). The distributions of five hypothetical species are shown in map (a), two non-endemics (A, B) and three species endemic to South Africa (C, D, E). The disaggregated global RLI uses assessments conducted for the global population and adjusts each species' contribution to the RLI by weighting it by the fraction of the species' distribution occurring within the country (hatched areas in map a). The National RLI uses assessments for only the proportion of the population falling within a country's borders (map b). Assessments for the endemic species C, D, and E will be the same for both indices, but the assessments for the non-endemic species A and B may differ because they are being assessed over a much broader area for the disaggregated global RLI. Further, the assessments for species A and B will contribute less to South Africa's disaggregated global than national RLI because they will be downweighted by the proportion of their ranges occurring in the country

species which are secure or increasing elsewhere in their ranges. By contrast, such trends would have a significant impact on the national RLI as these species would be weighted equally to all other species occurring in the country (Figure 1, map b), resulting in potentially very different RLI values due to the different the method used to calculate them. A nation's effectiveness in reducing national extinction risk for the populations of species that they are accountable for would thus best be reflected through the national RLI.

However, because individual nations hitherto have selected different taxonomic groups to produce their national RLIs and assessment methodologies often vary (Han et al., 2017), national RLIs cannot be rolled up for tracking of global goals and targets, nor can they be used to compare progress across countries. By contrast, the disaggregated global RLI derives from a single global dataset (the IUCN Red List), is available for all countries for the same taxonomic groups, and therefore allows for comparison of nations' contributions to the global conservation of species.

As nations prepare to adopt a post-2020 Global Biodiversity Framework, and with increased focus on promoting the use of standardized indicators to measure progress against the new targets (Bhatt et al., 2019), nations need to consider and justify indicators within a globally negotiated framework for national reporting. The RLI has been proposed as one of a select group of headline indicators (CBD, 2021; Williams et al., 2021), and nations must now decide how best to apply the two RLI approaches, which have different resourcing implications: the national RLI requires long-term investment in national species assessment programs to ensure periodic repeat assessments are conducted, while the disaggregated global RLI is free to use "off the shelf."

Here, we consider the use of the RLI as an indicator to report against the CBD's Strategic Plan for Biodiversity as evidenced in the 6th National Reports to the CBD. We evaluate the breadth of data included in the global RLI for use in national reporting and make recommendations for improving this indicator for national use. Finally, by focusing on three country case studies (Finland, South Africa, and Brazil), each with differing levels of species endemism and at varying stages of implementing species assessment programs, we offer advice to government reporting agencies and national biodiversity monitoring and assessment teams on how best to utilize the two RLIs available in the post-2020 GBF.

2 | CURRENT UTILIZATION OF RLI BY CBD PARTIES

The RLI was a recommended indicator for tracking global progress for species conservation against nine of

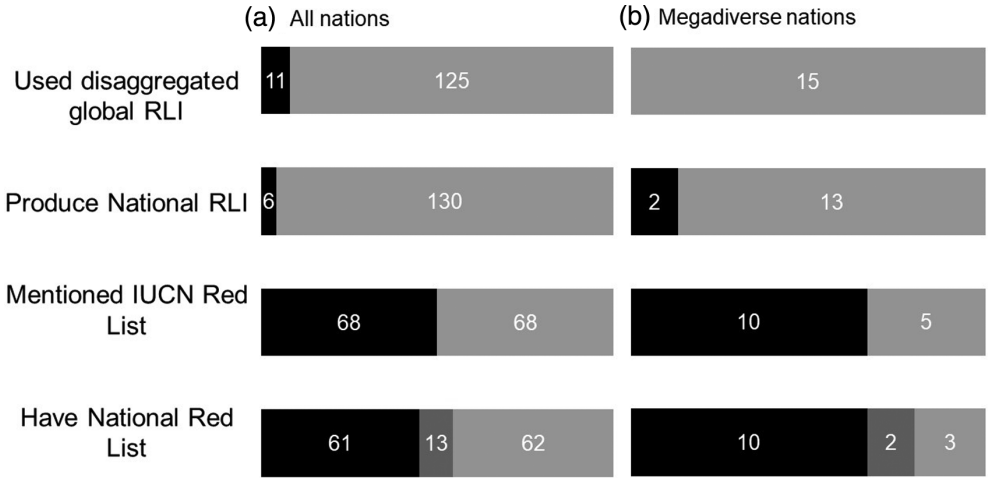

FIGURE 2 A summary of the 6th National Reports to the Convention on Biological Diversity's (CBD) indicating the number and proportion of countries that (1) used the global disaggregated Red List Index (RLI), (2) produced their own national RLI, (3) mentioned the IUCN Red List in their reporting, (4) produced their own national Red List; (a) all nations with 6th National Reports submitted ($n = 136$) and (b) megadiverse nations with 6th National Reports submitted ($n = 15$). Black—yes, gray—no, dark gray—in progress

the Aichi Biodiversity Targets (CBD, 2016) and was available for reporting national progress toward Aichi Target 12 for all countries. However, notwithstanding the frequent reference to the IUCN Red List in national reporting (McCay & Lacher, 2021), there was relatively little uptake of the RLI in National Reports submitted to the CBD as of October 14, 2020 (Figure 2, see Supplementary Information for methods). Only six of 136 nations (4%) that submitted reports produced their own national RLIs, and three of these (Sweden, Finland, and South Africa) followed the recommended IUCN methodology (see Bubb et al., 2009). A further 10 nations (7%) reported the disaggregated global RLI. Despite high levels of endemism, none of the 17 most biologically rich ("megadiverse") nations (Mittermeier et al., 2005), used the disaggregated global RLI in their reporting (Figure 2). Poor uptake of agreed indicators in national reporting is not unique to the RLI; overall uptake of indicators recommended by the CBD has been low (Bhatt et al., 2019). This seems due in part to the delayed release of recommended indicators, which were only published in 2016 (CBD, 2016) and a tendency for nations to prefer to use nationally generated indicators (Bhatt et al., 2019; CBD, 2020b; Han et al., 2017). A further reason is the prerequisite of repeat assessments for calculating national RLIs. Repeat assessments take time and require resources to build upon first assessments. With over 50% of nations having published a national red list for at least one taxonomic group or with such efforts currently underway (Figure 2), baselines exist from which repeat assessments can be conducted and national RLIs calculated. Efforts to promote standardized use of indicators for the post-2020 framework are underway, and the RLI remains one of the most commonly proposed indicators to track progress (CBD, 2021). Increased uptake of this indicator is possible, but many countries may require technical assistance in developing national RLIs.

3 | DISAGGREGATION OF THE GLOBAL RLI FOR NATIONAL REPORTING

Because the RLI weights each taxonomic group equally, country-level disaggregations of the global RLI can be heavily influenced by changes in one taxonomic group if few taxonomic groups are included (Bubb et al., 2009). Currently, five comprehensively assessed taxonomic groups are included in the global RLI: mammals (5801 species); birds (11,126 species); amphibians (6771 species); cycads (307 species); and reef-forming corals (868 species) (IPBES, 2019). Birds and mammals are both sufficiently speciose and widely distributed such that once the global RLI is disaggregated they are present in the majority of nations and dependent territories (hereafter referred to as "nations") (Figure 3). While speciose, amphibians are not well represented in cold or arid regions (Duellman, 1999). Reef forming corals and cycads have relatively few species and their distributions are more limited than amphibians. Of the 256 nations, only 10 have all five groups represented, while 56 have four groups, leaving 74% of nations with three or fewer taxonomic groups contributing to their disaggregated datasets. To facilitate clear understanding by countries of what this index represents, platforms that serve the disaggregated global RLIs should state clearly how many

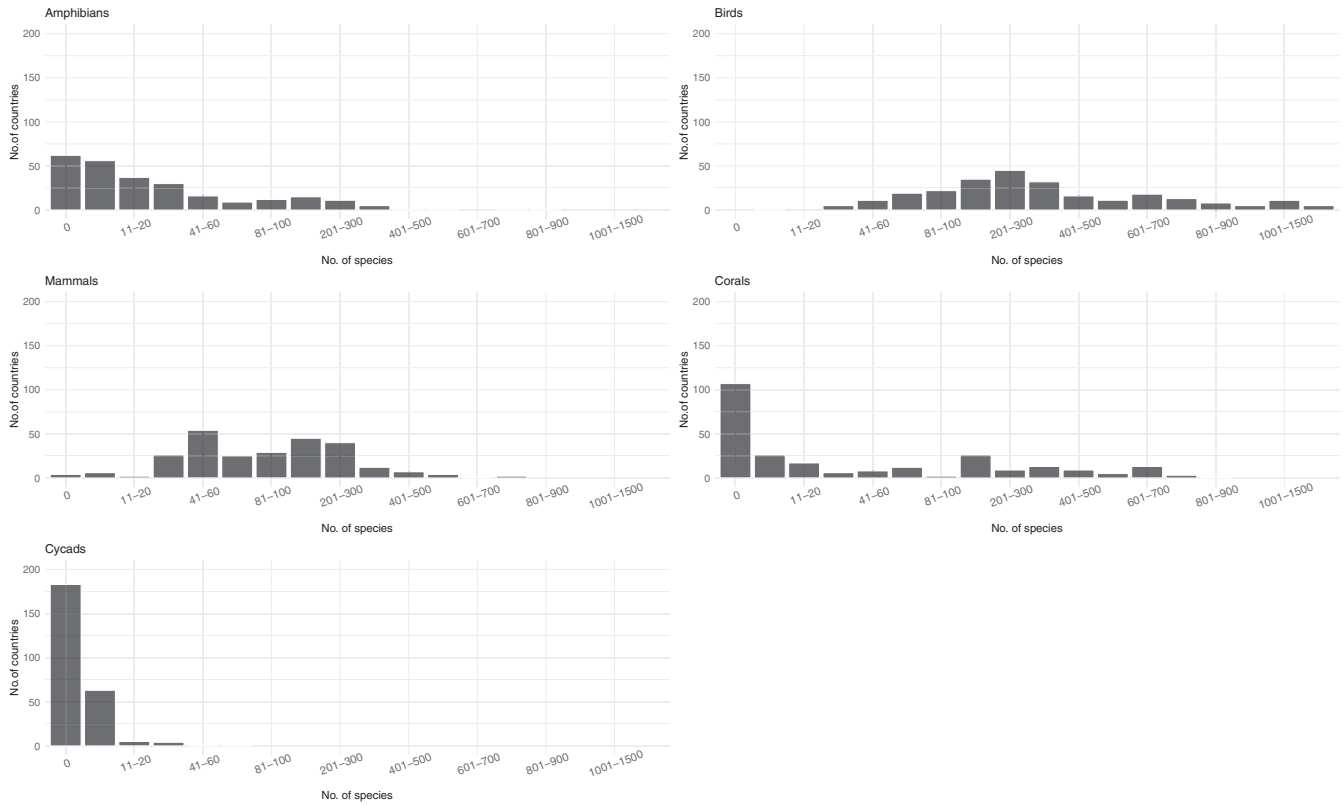

FIGURE 3 The number of species occurring per country or dependent territory for each taxonomic group used for calculating the disaggregated global Red List Index (RLI). Original data from range maps available on http://datazone.birdlife.org/species/requestdis and https://www.iucnredlist.org/ downloaded October 2021

species, in which species group, contribute to a given national disaggregation. They could also show individual taxonomic group RLI trend lines that contribute to the combined disaggregated RLI, where these are based on sufficient species to provide meaningful taxon-specific trends. Finally, they could ensure linkages to the underlying data on which species have—and have not—undergone genuine changes over the time-period in question, for the country in question.

4 | BROADENING SPECIES REPRESENTATION IN GLOBAL AND NATIONAL RLIs

Since country-level disaggregations of the global RLI are already in wide use on platforms that display biodiversity indicators, the global RLI should include a wide array of taxonomic groups that are broadly representative of the marine, terrestrial and freshwater realms. In reality, at both the global and national level, inclusion of taxonomic groups on the RLI is limited by the availability of data, expertise and resources to reassess extinction risk regularly. These are more readily available for the better studied vertebrate taxa, while for more speciose groups of invertebrates, plants and fungi, data are patchy, creating challenges for globally comprehensive assessments (Baillie et al., 2008; Brummitt et al., 2015). Conversely, conducting comprehensive assessments at the national level for speciose groups is often possible if species experts are based in country or actively work there. The current global RLI better represents vertebrates and the terrestrial and marine realms, with freshwater species, invertebrates, fungi and plants poorly represented.

To reduce the taxonomic bias and minimize the time and resources required to develop and remeasure RLIs, a sampling approach to Red Listing was developed (Baillie et al., 2008). The approach uses a random sample of 1000–1500 species, with larger samples being more effective in detecting changes in the slope of Index values (Henriques et al., 2020). Sampled RLIs are useful for improving taxonomic representation on the global RLI, and when disaggregated have sufficient species to produce meaningful RLIs for nations with high levels of endemism (megadiverse nations), but too few species for producing meaningful disaggregated RLIs for most countries. Considering that comprehensive assessment at the national level for speciose groups is feasible, adopting

standard taxonomic groups for comprehensive assessment at national levels and sampled assessment at the global level would improve taxonomic representation in the global RLI and allow comparisons across national RLIs. Use of standard groups would provide synergistic benefits as national assessments could inform global assessments and vice versa.

Standard groups that are broadly distributed, representative of different biomes, and well-studied could include freshwater and marine fishes, butterflies (Rhopalocera clade of the Lepidoptera), foliose fungi (family Parmeliaceae), and legumes (family Fabaceae; for which a sampled RLI already exists, Brummitt et al., 2015). Repeat global comprehensive assessments underway or planned will also reduce taxonomic bias in the global and disaggregated global RLIs. The sharks, rays and chimeras (class Chondrichthyes, 1224 species) have recently been comprehensively reassessed (Dulvy et al., 2021) and are ready for incorporation into the global RLI. In addition, recent first comprehensive assessments of dragonflies and damselflies (order Odonata, 6016 species; IUCN, 2022) and reptiles (10,196 species; Cox et al., 2022) provide important baselines for future reassessment that would extend the taxonomic and ecological breadth of the global RLI even further.

5 | CASE STUDIES OF NATIONS PRODUCING NATIONAL RLIs

National RLIs provide trends in national extinction risk for species in-country, yet require leadership, coordination, and investment in assessments. Here, we present three case studies chosen to illustrate how governments may organize species experts to conduct assessments that can lead to a national RLI. The case studies include two nations with longstanding species monitoring programs but contrasting levels of endemism, Finland and South Africa. The third example, Brazil, has only recently begun to assess species at the national level comprehensively, but future reassessments will help meet monitoring commitments for the Post2020 Global Biodiversity Framework.

5.1 | Finland

Finland has produced national Red List assessments for 22,418 species from 40 taxonomic groups, all of which comply with the IUCN guidelines for regional assessments (IUCN, 2012). Assessments were conducted in 2010 and 2019 by 170 experts on 18 taxonomic groups and co-ordinated by a Steering Group appointed by the Ministry of the Environment to ensure standardization of approach and independent evaluation (Figure 4). Twelve taxonomic groups—birds (246 taxa), mammals (58), reptiles (5), amphibians (5), fishes (75), dragonflies (54), butterflies (2362), beetles (3519), true bugs (1433), plants (1176), polypores (3967), and lichens (1944)—were included in Finland's 2019 national RLI as comprehensive assessments had been completed in 2010 and 2019 (Figure 4). Finland's National Red List and RLI thus includes six taxonomic groups poorly represented on the global IUCN Red List including fungi, lichens, plants, and three orders of invertebrates. It is representative of marine, terrestrial and freshwater realms and has a sufficiently large sample to allow disaggregation by habitat types (Hyvärinen et al., 2019). Finland has no endemic species within its national red list, and because only a small proportion of many of their species' global ranges fall within the country's borders, the effects of Finland's environmental impacts, and its conservation measures on the protection of the global population are generally small. The disaggregated global RLI for Finland is high at 0.989 in 2018 (meaning that few species' global populations are close to extinction) with only three taxonomic groups birds, mammals and amphibians contributing (Figure 4). Even if additional taxonomic groups were included on the global RLI, Finland's low levels of endemism mean that the disaggregated global RLI would still be insensitive to changes in species populations within the country. In contrast, the national RLI shows a number of taxonomic groups where the extinction risk within Finland is increasing. Deteriorations are particularly concerning for birds and lichens. By contrast, national extinction risk of Finland's mammals is decreasing with improvements due to conservation interventions implemented at the national scale. This example demonstrates how a country with low species endemism can use a national RLI to be able to provide sensitive reporting on its species extinction risk.

5.2 | South Africa

South Africa is a megadiverse nation with high levels of endemism; close to half of the South African reptiles, amphibians, butterflies, freshwater fish and two thirds of South Africa's plants are endemic (Supplementary Information Table S2). The South African National Biodiversity Institute has led the assessment of 23,331 taxa (Table S2). The majority (20,401 taxa) are plants. Eight groups, birds (732 taxa), mammals (336), reptiles (397), amphibians (126), freshwater fish (118), dragonflies (163), butterflies (799), and plants (900 sampled taxa), have been repeatedly assessed and a national RLI

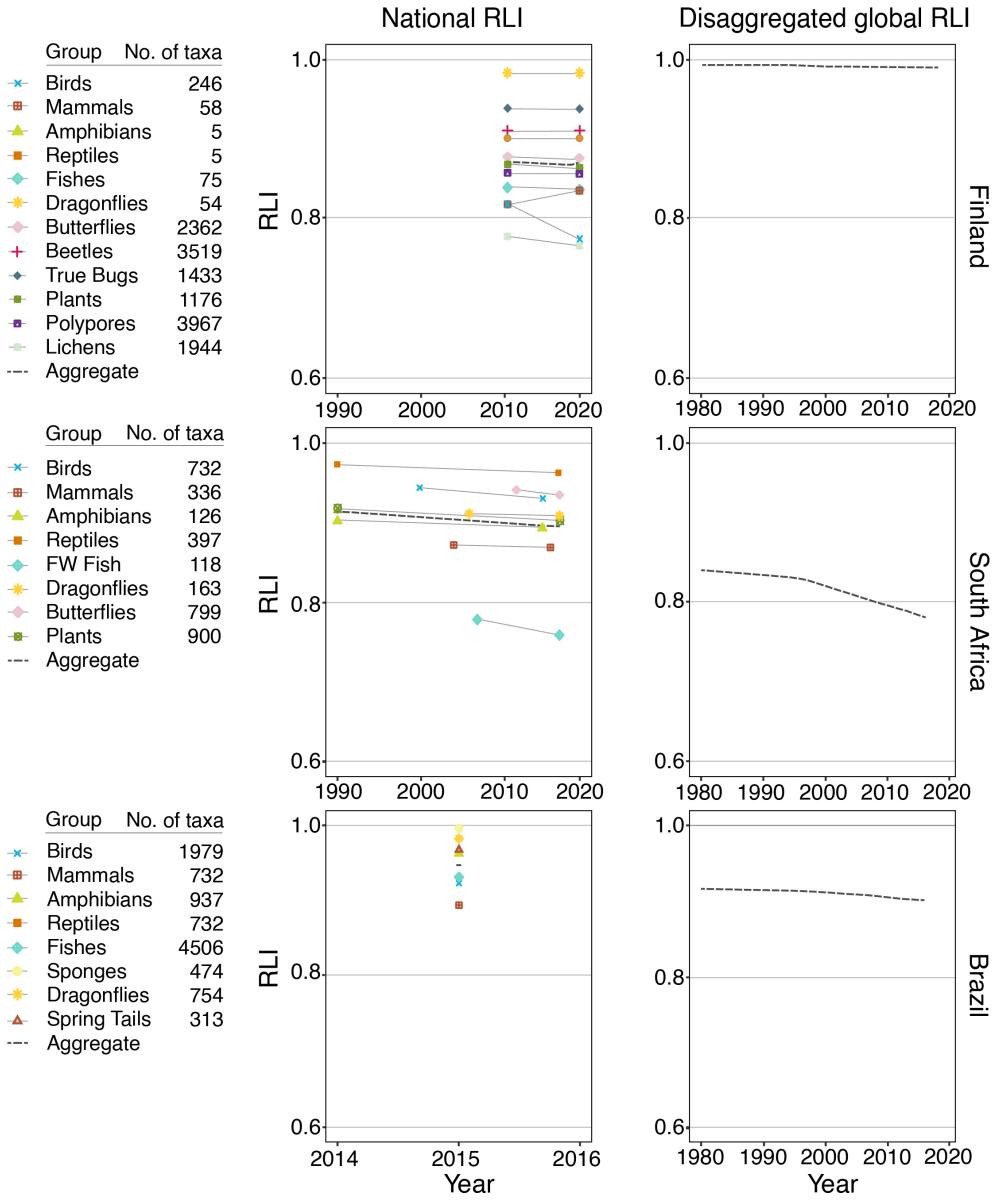

FIGURE 4 The two metrics used to report species extinction trends, national Red List Index (RLI; left panels) and the disaggregated global RLI (right panels) produced for Finland (top), South Africa (middle), and Brazil (bottom). Individual taxonomic group RLI trend lines are not currently presented as part of the disaggregated global RLIs

generated (Figure 4). A sampled approach was used for plants since capacity and resources are not available for repeat assessments of 20,401 taxa. Terrestrial and freshwater invertebrates, plants, and vertebrates are represented on the national RLI. The steep RLI decline for butterflies provides a signal that pollinators may be declining and has resulted in new monitoring programs being established to track trends for additional pollinator groups. The overall high extinction risk and ongoing declines of freshwater fish provide a clear policy message on the impact of overextraction and pollution of South Africa's river systems. Freshwater species and invertebrate pollinators are currently not represented on the global RLI, and South Africa would not have been able to inform its government policies for these if only the disaggregated global RLI was available for reporting.

The disaggregated global RLI for South Africa is based on five taxonomic groups and reveals greater deterioration in the national contribution to global extinction risk for these groups than are revealed in the deterioration in national extinction risk for eight groups (Figure 4). The inclusion of cycads strongly influences South Africa's disaggregated global RLI as cycads are the most threatened plant group both globally and in South Africa (Brummitt et al., 2015; Raimondo et al., 2009). Any nation that has substantial cycad species richness would also likely have similarly large deteriorations in their disaggregated global RLI. The sampled South African plant RLI used for the national RLI is more broadly representative, comprising species sampled from all higher plants (Tracheophyta). Cycads are included in the plant sample, but their contribution is

proportional to their diversity relative to all higher plants. South Africa's example emphasizes the value of nations investing in monitoring speciose groups and ensuring taxonomic groups from different habitats are included. It also highlights the need for the global RLI to be expanded to include more taxonomic groups to ensure one group does not overly influence the disaggregated global RLI trend.

5.3 | Brazil

Brazil is one of the most biodiverse countries in the world, and a total of 53% of taxa within assessed groups are endemic (Supplementary Information, Table S2). The Chico Mendes Institute of Biodiversity Conservation (ICMBio) has led the comprehensive assessment of eight animal taxonomic groups that include both vertebrates and invertebrates from the marine, terrestrial and freshwater realms: birds (1979 taxa), mammals (732), reptiles (732), amphibians (973), fishes (4506), sponges (474), dragonflies (754), and spring tails (313). While these groups have so far been assessed only once, in 2015, a first point for a national RLI has been calculated at 0.9458 (Figure 4). In contrast, while all five currently globally assessed groups are included in the disaggregated global RLI, both cycads and corals are poorly represented in Brazil with five and 18 taxa, respectively (Figure 4), and so their inclusion as two of five equally weighted indicator species groups gives them disproportionate weight. Brazil has completed 10,463 assessments for the eight animal groups mentioned above and 7561 plant species, with comprehensive reassessments planned for 2025. A sampled index for plants is currently being developed and will be included in Brazil's national RLI when available. Thus, Brazil is well on track to report on national species extinction risk trends (2015–2025) for the next CBD report using a national RLI representative of many taxonomic groups. This example demonstrates that it is possible to organize species expert teams to conduct assessments across a wide range of taxonomic groups even in countries with high species diversity.

5.4 | A call for nations to report both national and global RLIs post-2020

The three countries showcased here demonstrate that producing national RLIs is feasible, even for nations with large numbers of species in the groups being assessed. However, producing national RLIs involves conducting assessments at multiple time intervals and can be resource intensive and time consuming. Costs per species for Red List assessments in the three case studies varied from $64 to 162 (Table 1). In comparison, costs for species assessed globally vary between $76 and 368 (Juffe-Bignoli et al., 2016; Rondinini et al., 2014). Brazil had significantly higher costs than Finland and South Africa (Table 1) due to the large number of in person workshops where travel costs are high due to the size of the country. In the post-COVID era, the costs of national assessments are expected to be significantly reduced through the use of online platforms to avoid review workshop costs. Even without reduction in assessment costs, the examples of Finland and South Africa indicate that undertaking a manageable but informative number of assessments, of 5000 species assessed every 10 years, would cost approximately $300,000. This quantification can be used to inform resourcing requirements for implementation of the CBD's proposed monitoring framework (CBD, 2021).

Additional benefits are gained when countries produce national RLIs. Investment in species assessment programs has proved valuable in providing the evidence base to guide species conservation policy. In each country featured here, there has been a proliferation of legislation for the protection of species and an increase in species-focused conservation efforts following the completion of national Red List assessments. For example, Brazil produced a National Strategy for the Conservation of Threatened Species endorsed by the federal government (MMA Administrative Ruling No. 444, of November 26, 2018).

	Finland	South Africa	Brazil
Years conducting assessments	3	5	5
Total number of hired staff	20	9	36
Financial cost of hired staff	$1,324,688	$372,308	$343,288
Workshop expenses	$130,512	$15,067	$1,345,966
Total cost	$1,455,200	$387,375	$1,689,253.73
Number of assessments conducted	22,418	5570	10,463
Cost per assessment $	$64.46	$69.55	$161.45

TABLE 1 The resources required by Brazil, Finland, and South Africa to produce national Red List assessments. All financial values are US dollars

This strategy guided the implementation of conservation measures, including expansion of protected areas and adequate implementation of National Action Plans for the Conservation of Threatened Species. In South Africa, detailed spatial data for threatened species produced during national assessments inform Environmental Authorisation processes via an online screening tool which developers are regulated to use under Notice 43855, October 30, 2020 of the National Environmental Management Act. Because many decisions that affect species conservation are taken at the national level, investment in national species assessments and the involvement of policy makers in the assessment processes (Young et al., 2014) provide insights that inform appropriate conservation actions needed to reverse species declines. Repeat national assessments allow the calculation of national RLIs, providing the opportunity for nations to reflect trends in populations of species for which they are responsible and to monitor the impacts of conservation measures taken nationally. We therefore encourage nations to set up species monitoring programs in order to calculate and report national RLIs post 2020, aligning where possible the selection of taxa with those groups being monitored globally, while still taking into account national resource constraints.

Meanwhile, the global RLI is an essential indicator of trends in species extinction risk globally (CBD, 2020a; IPBES, 2019) and, once disaggregated to the national level, provides a standardized comparison of all nations' responsibility to the survival of the same set of species assessed globally. However, since the RLI should be as broadly representative of the species diversity present in each nation as possible, and currently 74% of nations have only three or fewer taxonomic groups contributing to their disaggregated global RLIs, it is necessary to track changes in extinction risk via RLIs for more taxonomic groups that are well distributed globally. The partnership responsible for the IUCN Red List (https://www.iucnredlist.org/about/partners) could therefore usefully prioritize efforts to expand the taxonomic and geographic representation on the global RLI. The three case studies presented show that when countries produce national RLIs they select taxonomic groups for which data and capacity are available. Finland, for example, managed to organize experts across 12 taxonomic groups and has completed far more repeat assessments (Figure 4) than the other two countries, which, despite being megadiverse addressed only eight groups each. The uneven distribution of resources available for species assessment is one reason why national RLIs currently differ among nations, hindering meaningful comparison of national contributions toward global targets. We therefore recommend that nations work on monitoring a standard subset of groups which should align to those on the global RLI, where resources are available additional groups can be included.

Nations with high levels of endemism (typically island and megadiverse countries) but limited resources for conducting assessments may consider using only the disaggregated global RLI and not conducting national assessments required for national RLIs. Any available resources should be targeted at conducting global assessments and reassessments for endemic species, within speciose groups that are difficult to assess globally (i.e., plants, invertebrates and fungi). Such an approach will help reduce costs and promote consistency. However, countries that follow this approach must be aware that trends in extinction risk for non-endemic taxa will not accurately reflect conservation interventions at the national level. For transparent reporting, countries choosing only to report the disaggregated RLI should include levels of endemism for each individual taxonomic group RLI trend line. Countries with low levels of endemism will want to rely on national RLIs for a representative portrayal of the change in species conservation status. They may also report the disaggregated global RLI as an additional metric that shows their contribution toward global risk of extinction.

As countries move forward to undertake national assessments, careful consideration should also be given to the assessment process. A number of countries have their own procedures; however, these may not be directly comparable to the IUCN global standards. We strongly recommend following the Guidelines for Application of IUCN Red List Criteria at Regional and National Levels (IUCN, 2012) so that assessments are comparable between nations. An additional benefit is that information on population distribution, size and trends from national assessments can contribute to producing accurate global assessments for the IUCN Red List, and assessments of endemics can be converted directly to global Red List assessments, augmenting coverage of the IUCN Red List. Co-ordination of assessments between nations and global assessment processes can reduce the time and costs. The IUCN's recent development of the online tool SIS Connect (https://connect.iucnredlist.org/) to batch import multiple assessments onto the IUCN Red List provides the mechanism to facilitate flow of assessment information between national and global red listing programs. Furthermore, use of the standardized IUCN Red List assessment methods will create local assessment capacity that can then be shared with other interested countries.

Three additional considerations are worth noting. First and most important, the most policy relevant RLIs are those disaggregated thematically, for example according to different habitats, or to track the impacts of different

threats (Butchart et al., 2010; McGowan et al., 2019). When selecting taxonomic groups to include in RLIs countries need to ensure that groups selected represent different habitats and samples of speciose groups are sufficiently large to be representative of different pressures. Second, while the two types of RLIs featured here capture two dimensions of species extinction risk trends, these should ideally be complemented with indicators capturing other species conservation dimensions, e.g. trends in population abundance (Wotton et al., 2020). Third, it is important to keep in mind that while many countries in the "global north" have low endemism and flat national RLIs and disaggregated global RLIs, these same nations often have high contributions to extinction risk beyond their borders, through consumption of imports (Lenzen et al., 2012). Development of methods to reflect such imported impacts within RLIs is an important research priority and could be based on recent suggestions to use conceptual models when identifying threats originating from non-local sources (Burgass et al., 2021).

Collaboration between IUCN global and national species assessment processes would enhance monitoring of species post-2020, especially through the focusing of assessment efforts on standardized groups and the harnessing the SIS Connect tool to support data exchange between the global and national Red Lists. The new CBD framework under development will have an increased focus on quantitative goals and targets (CBD, 2020b). The extent to which nations can effectively report against the new species goals and targets will depend both on how well the global RLI can incorporate more globally distributed taxonomic groups (for more meaningful national disaggregation) and on how readily parties are able to direct resources to develop capacity and establish national species assessment programs which utilize the standardized IUCN Red List criteria. Alignment of groups selected at national and global level will facilitate the production of transparent comparable RLIs and must be a focus of scientific technical exchange during this decade. Current CBD negotiations on commensurate resourcing should, take into account the costs required by low and middle income nations to build their scientific capacity to conduct local species assessments.

AUTHOR CONTRIBUTIONS

Domitilla Raimondo, led the writing of the manuscript, Bruce Young conducted the analysis of national reports and provided editorial support. Thomas Brooks and Philip McGowan contributed to writing sections of the manuscript with inputs focused on ensuring global relevance. The remaining authors are from the three pilot countries and contributed data and text to the manuscript linked to their respective country case studies: Brazil (Braulio Ferreira de Souza Dias, Ugo Vercillo, Estevão de Souza); South Africa (Dewidine van der Colff, Lize von Staden, Krystal Tolley); Finland (Pedro Cardoso, Aino Juslén, and Esko Hyvarinen).

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

The 6th National report data are available on the CBD Clearing House Mechanism website (https://chm.cbd.int/). Data to determine the number of species occurring per country or dependent territory for each taxonomic group used for calculating the disaggregated global RLI is available from BirdLife International but does need to be specifically requested via http://datazone.birdlife.org/species/requestdis. Nation Red List Index data can be obtained from country focal points D. Raimondo d.raimondo@sanbi.org.za (data from South Africa), A. Juslén aino.juslen@helsinki.fi (data from Finland) and U.E. Vercillo, ugoeichler@gmail.com (data from Brazil). Disaggregated Red List Indices are available from https://www.iucnredlist.org/.

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