



National and subnational Red Lists in European and Mediterranean countries: current state and use for conservation

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ABSTRACT: In the context of ongoing biodiversity loss and limited resources allocated to nature conservation, operational tools to prioritize and implement relevant conservation actions are crucial. The IUCN Red List of Threatened Species (RLTS) is recognized as the most comprehensive tool for assessing risk of species extinction, based on a standardized methodology that is applicable for most taxa and geographic regions. Now established at regional, national and subnational scales, Red Lists have grown rapidly and autonomously thanks to active local initiatives. We investigated national and subnational Red Lists in 53 European and Mediterranean countries to get an overview of their ongoing development and uses in this region in 2014. Through an online questionnaire, we identified national Red Lists in 41 countries and subnational Red Lists in 16 countries. The public sector is the main coordinator and funder of RLTSs, while the IUCN has a limited involvement in local initiatives. Availability of data and expertise are the main factors determining the choice of taxonomic groups to be assessed. Red Lists, notably national ones, are widely used in national conservation initiatives, mainly to prioritize species and sites. However, there are taxonomic and geographic coverage gaps and increased investment is needed to train experts and improve data quantity and quality. A worldwide strategy for development of regional RLTSs needs to be drawn up, along with the strengthening of a network of producers and users to increase their potential to contribute to biodiversity conservation.

KEY WORDS: National Red List · Subnational Red List · Threatened species · Conservation programs · Europe · Mediterranean region · Survey · IUCN

INTRODUCTION

Biodiversity loss is occurring at a rapid pace, and scientific evidence suggests we might be facing a sixth mass extinction (Butchart et al. 2010, Barnosky et al. 2011). In response to this crisis, the Convention on Biological Diversity (CBD) established as a main target to 'achieve a significant reduction of the current rate of biodiversity loss at global, national and regional

levels' by 2010 (UNEP 2014). This target was not met (Butchart et al. 2010), and ongoing changes in biodiversity and its dynamics are a growing concern for society (Pereira et al. 2010, Carvalho et al. 2013). As a consequence, the Parties of the CBD have agreed to a new strategic plan to prevent the extinction and improve the conservation status of threatened species by 2020 (CBD 2014). To achieve this objective, National Red Lists of Threatened Species (NRLTS) have been

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identified as a major indicator to monitor progress toward biodiversity targets (Zamin et al. 2010).

The IUCN Red List of Threatened Species (RLTS) is the most comprehensive source of information on species conservation status and threats (Lamoreux et al. 2003, De Grammont & Cuarón 2006, Mace et al. 2008, IUCN 2014b). It is used to inform the general public on species' conservation status, monitor the state of biodiversity, advise policies and programs, identify priority sites and species for conservation and orient scientific research (Rodrigues et al. 2006, IUCN 2011). The standardized methodology elaborated by the IUCN in 1994 and updated in 2001 allows the classification of species into 9 threat categories (IUCN 2012a, 2014a). The species classified in the Vulnerable (VU), Endangered (EN) and Critically Endangered (CR) categories are considered 'threatened.' Originally defined for use at the global scale (Mace & Lande 1991, IUCN 1994, 2001, 2012a), guidelines were produced to apply RLTS categories and criteria at the regional scale (Gärdenfors 2001, IUCN 2003, 2012b). Over the last decade, a growing set of RLTS has thus been established at regional, national and subnational scales to allow a better knowledge of local status of biodiversity conservation (Rodríguez 2008, Collen et al. 2013). The spontaneous development of national and subnational Red Lists of Threatened Species (NRLTSs and SRLTSs), emerging from local initiatives, quickly drifted away from the IUCN's coordination, leading to a divergence of standards for red listing. Therefore, the IUCN Species Survival Commission (SSC) National Red List Working Group established the National Red List Alliance (NRLA) to promote the NRLTS process globally. They implemented a website (National Red List 2014) aimed at gathering information on NRLTS assessments but, to this date, a complete list of NRLTSs in the Euro-Mediterranean region is not available.

On the other hand, several valuable studies have given an overview of the development of NRLTSs over the past decade (Köppel et al. 2003, Miller et al. 2007, Zamin et al. 2010). They show unequal geographic coverage of NRLTSs and that regions with the most important stakes for biodiversity have developed fewer NRLTSs (McKinney 1999, Zamin et al. 2010). Several methodological questions have also been raised, especially regarding the applicability of IUCN methodology to less well-known areas and taxa (Miller et al. 2007). Despite published recommendations (Miller et al. 2007, Rodríguez 2008), several points of confusion persist in the use of RLTSs (e.g. RLTSs used directly as a list of protected species

or as a template to establish conservation priorities), which hampers both the production and use of RLTSs for conservation (Possingham et al. 2002, Farrier et al. 2007, Martín-López et al. 2011).

Conservation programs and policies in Euro-Mediterranean countries are framed by international and community commitments such as Birds and Habitats Directives (Council of the European Commission, 1992, 2009) and the CBD (UNEP 2014, Cog Iniceanu & Cog Iniceanu 2010, Henle et al. 2013). The Mediterranean region, identified as a hotspot of biodiversity, is also one of the most threatened areas in the world (Myers et al. 2000, Cuttelod et al. 2009, Blondel et al. 2010). In this context, it is expected that species status assessments should feature prominently in conservation strategies but, so far, little information exists on the contribution of RLTSs to national programs. Information available on NRLTSs in Euro-Mediterranean countries is limited and the use of NRLTSs for conservation programs and policies has not previously been surveyed.

For the 50th anniversary of the IUCN RLTS, we investigated NRLTSs and SRLTSs in Euro-Mediterranean countries. Our study provides a regional overview of the state of development of RLTSs and their uses in national conservation strategies. Our aim was to identify trends in the development of NRLTSs and SRLTSs and assess their scope for conservation in this region.

METHODS

Online survey

We developed a questionnaire to obtain information on RLTS production, national conservation programs/policies and the use of RLTSs in those programs (see Supplement 1 at www.int-res.com/articles/suppl/n030p255_supp.pdf). We adopted several typologies to describe stakeholders, RLTS methodologies, taxonomic groups (19 groups selected), the determining factors for the development of RLTSs, conservation programs/policies, and uses of RLTSs. The questionnaire included 398 conditional questions (questions to be answered depending on the previous answer). It included closed and open questions, mandatory and non-mandatory questions as well as simple and multiple choice questions. In this last case, the sum of percentage in the results can be more than 100%. We built the online questionnaire (English/French) using the open source software LimeSurvey® (LimeSurvey 2011) (Supplement 1).

Data are unavailable for the Republic of Macedonia with respect to the use of Red Lists in national conservation policies and programs.

Participants in the questionnaire

The study area included 53 countries from Europe and around the Mediterranean basin. Invitations to participate in the online questionnaire were sent to 351 persons identified as working with RLTSs and national conservation strategies. Respondents were from public bodies, research institutions, NGOs and other civil society organizations, with an average of 6 persons per country (range: 2 to 19). The questionnaire ran for 6 wk from May to June 2014 (see Supplement 1 for more information).

Selection and grading of replies

Several individuals from each country may have answered the same question. According to a standardized protocol (Supplement 2 at www.int-res.com/articles/suppl/n030p255_supp.pdf), a synthesis of answers for each country was made and graded according to a level of confidence, from A (good) to C (low) based on the consistency, justification and documentation of the answers. Nine experts involved in international conservation initiatives were interviewed to confirm and/or complete the results. NRLTSs and SRLTSs can be elaborated according to different methodologies, at different periods of time and under different formats (RLTS or Red Data Book); all variants were included in the present study. A Red Data Book generally gathers information focusing on the most threatened and rare species and their conservation measures, while a RLTS aims at compiling risk assessments and associated data for an entire taxonomic group.

Primary classification of countries

We divided the countries into 3 groups depending on the sizes of their administrative regions: 'small-regions countries' (n = 18, sizes of administrative regions ranging from 2 to 3120 km²), 'medium-regions countries' (n = 18, size range: 3121 to 15 106 km²) and 'large-regions countries' (n = 17, size range: 15 107 to 75 346 km²) (GADM 2014). We also selected 14 significant descriptive variables (geographic, cultural and socio-economic) to characterize countries (Sup-

plement 3 at www.int-res.com/articles/suppl/n030p255_supp.pdf).

Description of results

The results are presented as percentages based on replies on closed questions, and exclude 'don't know' answers. Open questions are used for the interpretation and referred to in the 'Discussion'. Data are unavailable for the Republic of Macedonia for the second part of the questionnaire, i.e. the section concerning the uses of Red Lists in national conservation policies and programs.

Multivariate analysis

A principal component analysis (PCA) was performed to identify RLTS production strategies among countries. We also conducted a redundancy analysis (RDA) (see Supplement 3) to observe the relationships between conservation strategies and variables describing the countries. Kosovo, Belarus and Moldova were not included in this analysis, due to missing data in the survey results for these countries.

RESULTS

The survey

We received 322 questionnaires with answers (92% of invitations) and selected the 134 most complete ones (1 to 6 per country). Most respondents (83%) were from the public sector and research institutes. We had good confidence (A) in 45% of the answers per country and only 18% were deemed to present a low rate of confidence (C) (Supplement 2).

Current state of NRLTSs and SRLTSs in the Euro-Mediterranean region

Among the 53 countries surveyed, 41 had developed NRLTSs (Fig. 1), 8 planned to do so and 3 did not plan to develop one, mostly for operational reasons (lack of expertise/data availability). Twenty-two countries (54% of the countries with NRLTSs) had reassessed their NRLTS and 9 of them (22%) had compiled a Red List Index (RLI) (Butchart et al. 2005). SRLTSs were identified in 16 countries and 3 planned

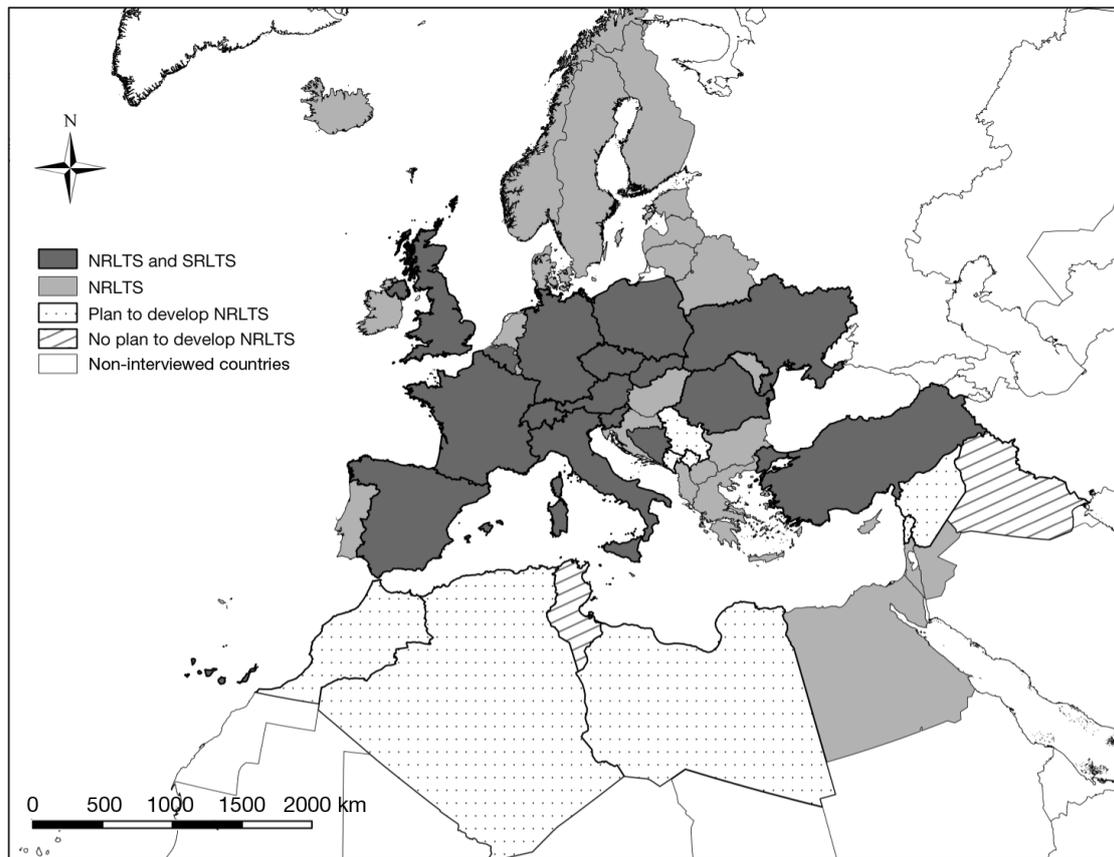


Fig. 1. Distribution of national (NRLTS) and subnational Red Lists (SRLTS) in Euro-Mediterranean countries in 2014. Map created with ARCGIS 10.2.2 (ARCGIS 2014)

to develop some within a few years. 53% of the countries without SRLTS stated that their administrative regions were too small for SRLTS assessments. SRLTSs were reassessed in 8 countries and RLIs based on SRLTS had been compiled in 5 countries (31%).

RLTS production stakeholders

NRLTSs and SRLTSs are mainly coordinated by the public sector (87% of the countries for NRLTSs and 81% for SRLTSs) and research institutes (primarily universities and natural history museums) (54% for NRLTSs, 38% for SRLTSs) followed by NGOs (29% for NRLTSs, 19% for SRLTSs) and managers of protected areas (10% for NRLTSs, 13% for SRLTSs). As the data makes clear, RLTSs can be coordinated by more than one organization in each country. The IUCN national committees have a moderate role in NRLTS coordination and, as of 2014, only the French and Italian national committees had a significant role in it. None of the respondents identified a private sector organization as coordinator of a NRLTS or

SRLTS. Respondents highlighted the prominent role of experts in leading RLTS initiatives. They contribute largely on a voluntary basis, in 43% of cases for NRLTSs and 63% for SRLTSs, and in some cases personally fund the production of an RLTS. The public sector is the main funder of RLTSs (95% of the countries for NRLTSs and 88% for SRLTSs) while the private sector makes a limited contribution (to 22% NRLTSs, 25% for SRLTSs); note again that RLTSs can be funded by more than one organization in each country. Nevertheless, private funding seems to be more important for SRLTSs than for NRLTSs: respondents from 19% of the countries stated that private organizations have a 'strong' participation in SRLTSs versus 5% for NRLTSs.

RLTS methodologies

NRLTSs were mostly elaborated following the 2001 IUCN methodology (IUCN 2001): 20 out of 41 countries (49% of countries with NRLTSs) adopted the IUCN methodology, while 16 countries (39%) used

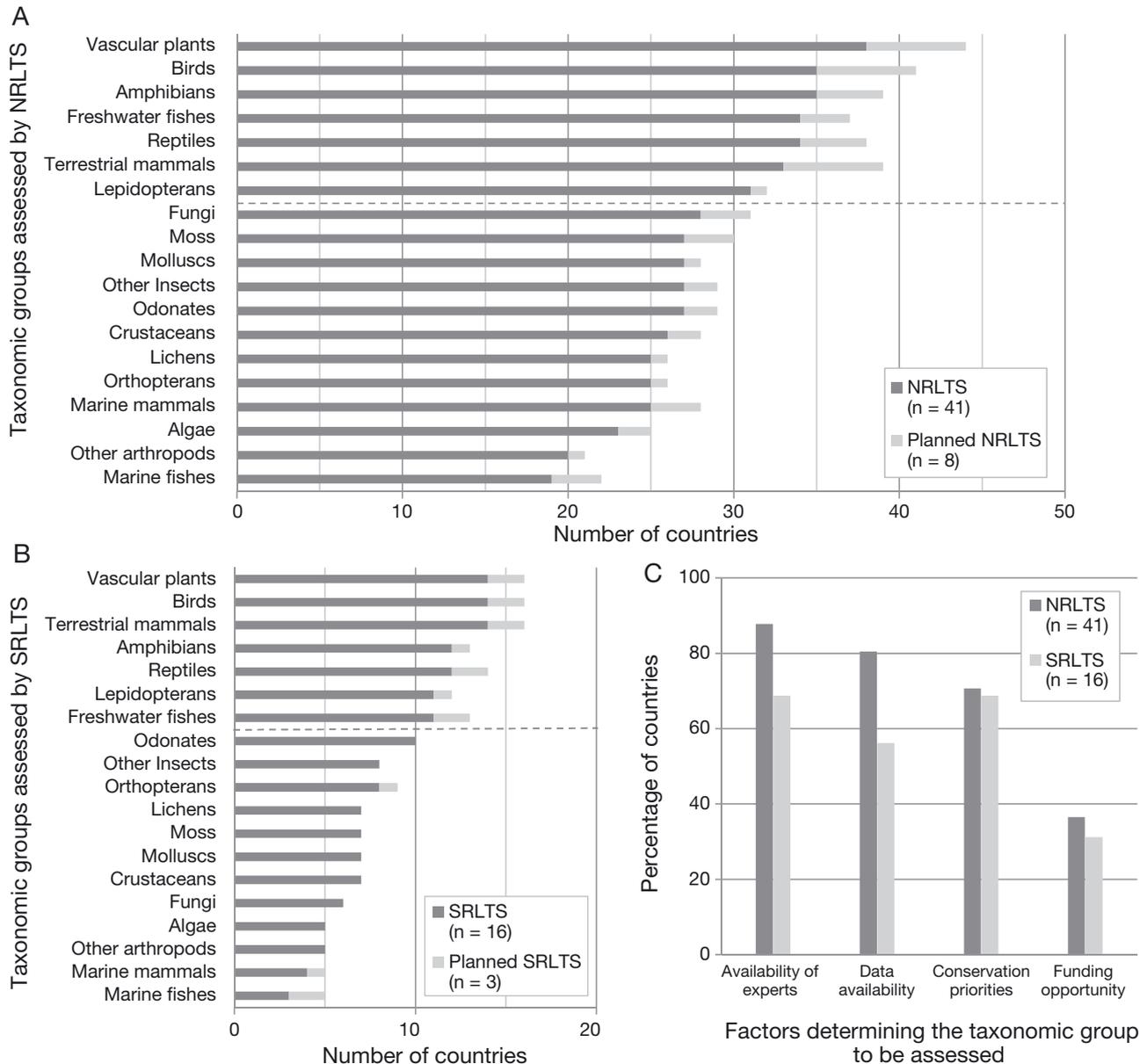


Fig. 2. Current and planned assessment of taxonomic groups assessed by (A) national Red Lists (NRLTS) and (B) subnational Red Lists (SRLTS) in Euro-Mediterranean countries. The dashed lines separate well assessed groups from less well assessed groups. (C) Factors determining the choice of taxonomic groups to be assessed by NRLTS and SRLTS, shown as the percentage of the countries that have developed NRLTS and/or SRLTS

a methodology adapted from the IUCN categories and criteria. Three countries (7%) used their own methodology and the superseded 1994 IUCN methodology (IUCN 1994) was used in 2 countries (5%). For SRLTSs, 10 out of 16 countries (63% of SRLTS countries) used their own methodologies, mostly based on the IUCN methodology. The 2001 IUCN methodology was used for SRLTS in 5 countries (31%) and the 1994 IUCN methodology in 3 countries (19%); note that more than one methodology can be used among the different subnational regions of a country. In re-

sponses to the open questions, respondents underlined the lack of coordination among SRLTS producers within a country and the difficulties involved in using SRLTSs developed from different methodologies.

Choice of taxonomic groups assessed by RLTSs

Fig. 2 shows the coverage of the 19 taxonomic groups selected by NRLTSs and SRLTSs. As expected, the most emblematic and well-known groups (vascular

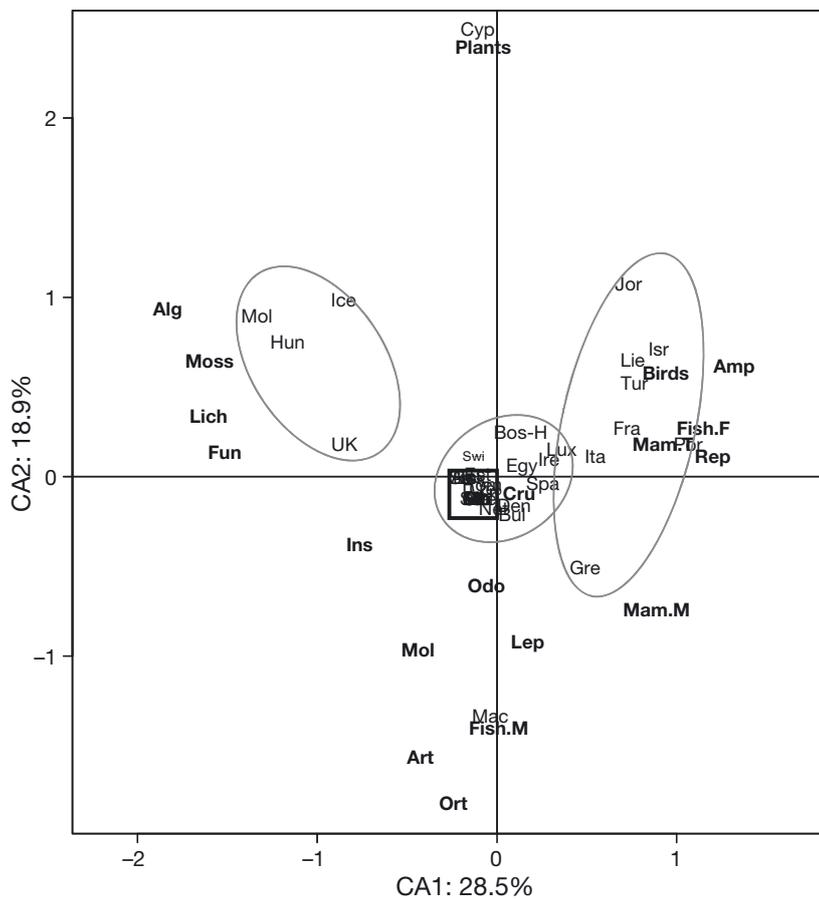


Fig. 3. Principal component analysis of coverage of taxa in national Red Lists of countries in the Euro-Mediterranean region. Ovals outline groups of countries that evaluated a broad range of taxonomic groups (center), focused on well-known groups (right), and were motivated by less well-known groups (left).

Country abbreviations. Bos-H: Bosnia and Herzegovina, Bul: Bulgaria, Cyp: Cyprus, Dan: Denmark, Egy: Egypt, Fra: France, Gre: Greece, Hun: Hungary, Ice: Iceland, Ire: Ireland, Isr: Israel, Ita: Italy, Jor: Jordan, Lie: Liechtenstein, Lux: Luxembourg, Mac: Macedonia, Mol: Moldova, Por: Portugal, Spa: Spain, Swi: Switzerland, Tur: Turkey, UK: United Kingdom. The black box in the center of the diagram contains the following countries: Albania, Austria, Belarus, Croatia, Czech Republic, Estonia, Finland, Germany, Latvia, Lithuania, Malta, The Netherlands, Norway, Poland, Romania, Slovakia, Slovenia, Sweden and Ukraine.

Taxonomic groups (in **bold**). Alg: algae, Amp: amphibians, Art: other arthropods, Birds: birds, Bryo: bryophytes, Cru: crustaceans, Fish.F: freshwater fishes, Fish.M: marine fishes, Fun: fungi, Ins: other insects, Lep: lepidopterans, Lich: lichens, Mam.M: marine mammals, Mam.T: terrestrial mammals, Mol: molluscs, Moss: mosses, Odo: odonates, Ort: orthopterans, Plants: vascular plants, Rep: reptiles

plants, vertebrates, Lepidoptera) were assessed more frequently than less well-known groups (fungi, most invertebrates, non-vascular plants, marine fishes). The 7 most assessed groups were the same for NRLTSs and SRLTSs (>30 and >10 countries respectively) and were also more frequently targeted for future RLTS assessments. The choice of taxonomic group to be assessed was influenced by expert availability (88% of the countries for NRLTSs and 69% for SRLTSs), data availability (80% for NRLTSs, 56% for SRLTSs), conservation priorities (71% for NRLTSs, 69% for SRLTSs) and, more rarely, funding opportunities (37% for NRLTSs, 31% for SRLTSs; based on responses to a multiple choice question).

A PCA analysis (Fig. 3) investigated interactions between traits of countries and the choice of taxonomic groups to be assessed by NRLTSs. Three distinct groups of countries emerged: (1) countries that evaluated a broad range of taxonomic groups; (2) countries focused on well-known groups; and (3) countries motivated by an interest in less well-known groups. This analysis identified a separation between the level of knowledge of taxa on the horizontal axis and the type of assessment on the vertical axis

(Fig. 3). Within countries focusing on less well-known taxa, 75% used a methodology adapted from the IUCN methodology, while 75% of countries focusing on well-known taxa used the 2001 IUCN methodology in its original form.

Biodiversity conservation strategies

Among the respondents from 52 countries that answered this part of the questionnaire, the most frequent programs/policies adopted were national lists of protected species (98% of the countries surveyed), national strategies for biodiversity (90%), programs of work on protected areas (85%), inventories of areas of biodiversity interest (85%) and national action plans (NAP) (83%) (Fig. 4). However, according to the commentaries, many of those programs are obsolete and/or have not been implemented. Thus, the apparent uniformity in national conservation strategies hides strong differences in the implementation of initiatives. Non-mandatory and small-scale initiatives were notably scarcer; these included biodiversity monitoring centers (50% of the countries),

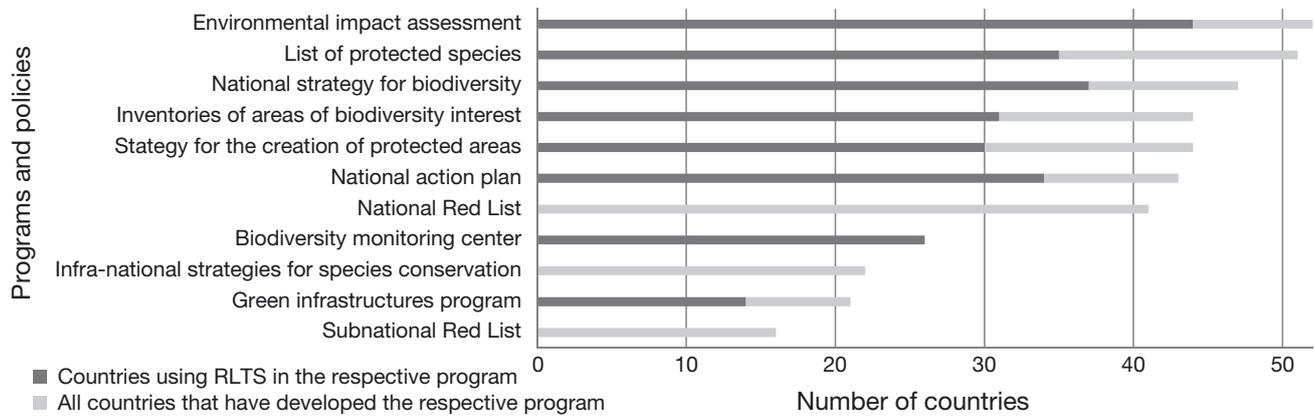


Fig. 4. Use of Red Lists (RLTS) in national conservation programs and policies, showing the number of Euro-Mediterranean countries ($n = 52$) that have developed each program (black bars) and the number that used national and/or subnational Red Lists in developing and/or implementing the program (grey bars). Note that data are not available for uses of RLTS in subnational strategies for species conservation

subnational strategies for conservation (42%) and green infrastructure programs (40%).

The mean size of the administrative regions of a country appeared to be a key factor in the development of subnational conservation strategies and SRLTSs. Such strategies were developed in 23% of the small-regions countries, 39% of medium-regions countries and 65% of large-regions countries. Within the 22 countries which had developed subnational strategies, 59% had also developed SRLTSs.

In order to understand the factors that shaped biodiversity conservation strategies in the studied region, we conducted an RDA to compare the existing programs and policies with the variables describing the countries. We found a 'north-south' divide where countries from Europe and with high socio-economic stability (based on the country risk assessment indicator developed by COFACE insurance company; Coface 2014) developed more programs than Mediterranean countries with low socio-economic stability. Countries with a temperate climate and a high level of endemism were more involved in NRLTS and SRLTS production than countries from the desert ecoregion (Fig. 3, Supplement 3).

Uses of RLTSs in biodiversity conservation initiatives

RLTSs were used by all biodiversity monitoring centers (100%) and in 67 to 85% of the cases to support other programs (Fig. 4, Supplement 4 at www.int-res.com/articles/suppl/n030p255_supp.pdf). When asked to classify which RLTS was preferentially used for conservation, NRLTSs were by far the most

widely used, followed by supra-national RLTSs (Mediterranean, European etc.) and then the global RLTSs. The exceptions were NAPs and ecological impact assessments (EIAs) for which the global RLTS was the second most commonly used type of RLTSs. SRLTSs were mainly used for small-scale initiatives, such as EIAs, green infrastructure programs and inventories of areas of biodiversity interest.

RLTSs were used mainly as a prioritization tool to select species or sites for conservation. On average, 87% of the countries that used RLTSs in the programs listed in the questionnaire (data unavailable for EIAs and biodiversity monitoring centers) declared a 'strong/medium' use of RLTSs for prioritization of species. We also identified 23 countries that had a recognized prioritization methodology, of which 83% cited RLTSs as the basis of the methodology. With respect to other uses, 81% of the countries used RLTSs for information and communication, 80% to advise policies and programs, 76% to monitor biodiversity status, and 70% to orient research priorities.

DISCUSSION

NRLTSs and SRLTSs have been successfully implemented in the European region thanks to a continuing mobilization of local stakeholders. Nevertheless, the general overview provided by our results reveals several limiting factors in this autonomous RLTS development: availability of data and/or experts, applicability of the methodology to some taxonomic groups or unknown areas, lack of coordination.

Nature of NRLTSs and SRLTSs

Defining an RLTS is a complex process as such a list can assess different areas (regional, national, subnational), include one or several chapters, assess an entire taxonomic group or just selected species, be published at different times from an RLTS or Red Data Book, and be elaborated according to different guidelines (Köppel et al. 2003, Miller et al. 2007). NRLTSs can have different objectives and uses depending on their implementation process (Burton 2003). For example, Germany, which is a driving actor in the development of NRLTSs, has assessed most taxonomic groups and uses the country's own RLTS methodology (BFN 2014). This methodology aims to assess whether or not a species can fulfill its role in nature, in contrast to IUCN methodology which focuses entirely on the risk of extinction. There are thus a range of different ways in which an RLTS can be produced and used.

RLTS development in the Euro-Mediterranean region

This review reveals a continuing development of NRLTSs and SRLTSs (in all their forms) in the region, driven by national public bodies. NRLTSs are mainly elaborated following the IUCN methodology, while SRLTSs are more frequently compiled using adapted methodologies. Indeed, SRLTSs are generally produced in response to specific needs, in an autonomous way and without national support. Differences among methodologies do not seem to inhibit their development. Nevertheless, respondents stated that it was difficult to combine SRLTSs produced using different methodologies for cross-scale conservation programs. They also expressed a desire for their tools to be more widely acknowledged and accorded greater credibility. This study shows a strong interest of local stakeholders in SRLTSs but, so far, the IUCN has not paid much attention to these emerging initiatives. However, SRLTSs, just as Rodríguez suggested for NRLTSs (Rodríguez 2008), could be a new expanding 'global market for IUCN Red List categories and criteria' that strengthens the data on the world's threatened species.

NRLTS and SRLTS coverage

Some taxa, such as non-vascular plants and most invertebrates, were underrepresented in NRLTSs

and SRLTSs (Köppel et al. 2003, Zamin et al. 2010), leading to a corresponding bias in conservation policies (Mace et al. 2008, Martín-López et al. 2011). While the focus is on species for which data is available, the lack of currently available data may conceal greater threats to other species (McKinney 1999). The same pattern can be observed at European and global levels (Miller 2013). However, it is encouraging that interest in developing RLTSs for under-represented groups of invertebrates has shown some signs of increasing in recent years. In 2008, Zamin et al. (2010) estimated that 53% of NRLTSs worldwide assessed at least one invertebrate taxon. The present study shows that 85% of Euro-Mediterranean NRLTSs contained assessments for invertebrates, although the majority concerned the most well-known taxa: Lepidoptera and odonates. However, it should be noted that this current state of taxa included in NRLTSs and SRLTSs is not a quantitative evaluation of the species assessed per country, as the survey did not ask for information on the number of species assessed.

We also identified a gap in RLTS coverage in most eastern and southern Mediterranean countries (Balmford et al. 2005, Green et al. 2005, Zamin et al. 2010). Most of these countries are part of the Mediterranean biome, which is recognized as a hotspot of biodiversity (Myers et al. 2000) and as being exposed to a high level of threat (Cuttelod et al. 2009). Zamin et al. (2010) attributed this gap in RLTS coverage to the lack of funding; however, our study downplays this hypothesis. Countries that did not plan to develop an NRLTS did not identify financial constraints as the primary obstacle, and funding availability was not a determining factor in their choice of which taxonomic groups to assess. Moreover, neither Gross Domestic Product (GDP; The World Bank 2013), nor a potential threshold GDP effect, was identified as a significant variable influencing a country's conservation strategy in the PCA analysis (Fig. S3 in Supplement 3). Instead, availability of data and expertise was identified as the major factor determining development of NRLTSs. Rather, lack of expert knowledge was identified as the principal constraint to RLTSs in these countries. Our study therefore confirms the essential role of experts for biodiversity knowledge and conservation (Miller et al. 2007, Coreau 2014, Hjarding et al. 2015). Respondents highlighted the need for the training of conservation experts, along with structured support from political decision makers and international organizations for the production of NRLTSs. In this regard, the elaboration of the Mediterranean RLTS could function as a structuring

initiative to build capacity at national and subnational levels. It can also help towards harmonizing data quality and assessment processes around the Mediterranean basin. This initiative should include increasing the mobilization and training of conservation stakeholders, especially from scientific and political sectors.

Role of RLTSs in biodiversity conservation programs and policies

Our review of biodiversity conservation programs and policies in the Euro-Mediterranean countries did not aim to be exhaustive but instead to give an overview of the conservation framework in the region. The review documents a 'north-south' divide in conservation programs, and a stronger development of programs linked to international commitments compared to locally based initiatives. The survey shows that the European Union, and especially its Birds and Habitats Directives, has been a driving force to strengthen conservation strategies in the member countries. Species diversity knowledge and data collection are stimulated by the Habitat Directive progress reports and the development of protected areas (and green corridors) by the Natura 2000 network. Some countries adopted the species listed in the annexes of the Directives as a national list of regulated and protected species without any modification. However, conservation priorities at the European level are not always representative of local priorities, and stakeholders need access to locally adapted tools to design conservation strategies. In the context of a much needed harmonization of European strategies to increase the efficiency of conservation efforts (Bladt et al. 2009), NRLTSs and SRLTSs, in combination with European RLTS assessments, could be valuable tools to design standardized but adaptive programs at the EU scale.

This first international assessment of RLTS use in national conservation strategies shows they are actively used in at least two-thirds of the national programs of the surveyed countries. NRLTSs are the primary RLTSs used, while SRLTSs are more frequently used for small-scale programs. This strong and targeted use of NRLTSs and SRLTSs clearly justifies the multi-scale human and financial investment in RLTSs. Though the European RLTS is a valuable tool, subnational and national actors prefer using a scale-adapted tool that meets their specific requirements. The study also confirms the uses of RLTSs in determining species conservation priori-

ties, for information and communication, advice for policies and programs, monitoring of the state of biodiversity, and orientation for research, as outlined by previous work (Lamoreux et al. 2003, Rodrigues et al. 2006). No further major uses of RLTSs were identified by this study in responses to the open questions. National and subnational actors mainly use RLTSs for prioritizing species for protection. Nevertheless, a confusion persists between risk of extinction and conservation priorities or rarity (Miller et al. 2007, Fitzpatrick et al. 2007, Mace et al. 2008) that can affect RLTS efficiency and constrain support from policymakers (Possingham et al. 2002, Lamoreux et al. 2003). As a prioritization tool, RLTSs must be associated with other factors such as national responsibility and opportunities for action (Keller & Bollmann 2004, Rodríguez et al. 2004, Schatz et al. 2014, Schmeller et al. 2014). The combination of multi-scale RLTSs (including available assessments from the global, regional, national and subnational RLTSs) can also provide valuable information during prioritization processes (Barneix & Gigot 2013). The combination of RLTSs with other knowledge products such as the Red List of Ecosystems (Keith et al. 2013) and Key Biodiversity Areas (Foster et al. 2012) also provides great potential for enhanced conservation planning.

The various strategies employed in producing NRLTSs highlight the differences in the way NRLTSs are used. For example, France has assessed most well-known groups following the 2001 IUCN methodology and with the support of the IUCN national committee (IUCN France & MNHN 2009). The NRLTS is one of the major prioritization tools used in most of the national conservation programs in France. In contrast, the United Kingdom has mainly assessed less well-known groups (JNCC 2014) using the 2001 IUCN methodology complemented with national criteria. Other taxa are assessed through other tools, for example the programme Tracking Mammals Partnership developed by the JNCC (JNCC 2005). This indicates a different ownership of the tool as well as different needs between countries.

Strengthening NRLTS and SRLTS consistency through improved coordination

NRLTSs and SRLTSs are elaborated following different methodological guidelines, which complicates the use of RLTSs at other scales. Answers from respondents showed that this is particularly problematic for SRLTSs that can rarely be combined for use in

national programs. However, using multi-level RLTSs is a benefit to conservation as it facilitates the multi-scale mapping of threats (Brito et al. 2010). To fully realize this potential, RLTSs must be consistent across scales and follow a similar methodological approach. Consistent RLTSs could, among other things, provide the global RLTS with valuable information from NRLTSs and SRLTSs assessments, especially for endemic species, and support cross-border cooperation for conservation (Rodríguez 2008). This would improve the role of RLTSs as ‘barometers of life’ (Stuart et al. 2010).

To strengthen RLTS consistency, communication must be improved among RLTS producers (Miller et al. 2007). Meetings like the European seminar on the harmonization of NRLTSs in Europe in 2002 (De Iongh et al. 2003) are excellent initiatives but they should be scheduled on a more regular basis. Strengthening the NRLTSs and SRLTSs network would allow sharing of experience to facilitate the application of IUCN methodology, especially for less well-known species or undocumented areas.

The NRLA has been set up with this objective but it needs to strengthen its role as a link between RLTS actors. The nationalredlist.org website could provide good support but it would need regular updates as well as a section for RLTS users to exchange information on RLTS uses and prioritization processes. This network strengthening would be the next step for NRLTSs and SRLTSs toward becoming a key tool for inter-regional and trans-boundary cooperation for species conservation (Kark et al. 2009). A worldwide strategy is needed to fill the gaps in NRLTSs and SRLTSs coverage through funding and knowledge transfer initiatives. Such a strategy has to include an RLTS quality control process to harmonize development of RLTSs and increase linkages between the multiple levels of RLTSs.

CONCLUSION

National and subnational RLTSs have come a long way. RLTSs are now a valuable reference tool for conservationists, who have access to global, regional, national and subnational assessments to plan their conservation actions. This study confirms previous findings (Köppel et al. 2003, Miller et al. 2007, Rodríguez 2008, Zamin et al. 2010) and provides an updated and more detailed view on NRLTSs and SRLTSs. For the first time, specific information on SRLTSs development and the use of RLTSs in national conservation programs is made available, which we

hope will help conservationists and decision makers during conservation and policy planning. Though comparative research on RLTSs in other geographical regions is needed, this overview for the Euro-Mediterranean region provides us with some interesting insights. Three main actions are needed to address the unequal development and use of NRLTSs and SRLTSs:

(1) Improved training should be provided and increased resources made available to experts on a worldwide scale. This is the key to increasing the data on underrepresented taxa and geographical areas. The IUCN could then develop specific guidance and stimulate specialist working groups (e.g. for invertebrates; Proctor & Harding 2005, Cardoso et al. 2011).

(2) The IUCN should provide more widely available guidelines on the application of IUCN methodology, especially for less well-known taxonomic groups (IUCN 2014a), and the appropriate use of RLTSs for conservation (IUCN 2011). Following the increasing interest in SRLTSs, specific recommendations for SRLTS actors must be drafted. For example, the national IUCN committee in France, in collaboration with local partners, is in the process of producing guidelines on the development and use of SRLTSs (IUCN France 2011). However, we remind local actors that a considerable amount of information is already available on the website (www.iucnredlist.org) as well as RLTS training on www.conservationtraining.org (The Nature Conservancy 2014).

(3) Increased coordination between RLTS stakeholders at all scales (from global to subnational) is required. The NRLA needs more support from the international community to fulfill its coordinating and support function efficiently as well as maintaining an updated website (www.nationalredlist.org). However, in the context of limited resources, national and subnational actors also have their parts to play. We strongly encourage these actors to contact the NRLA acting at a larger scale and those in neighboring countries/regions to share experiences and pool efforts towards a better assessment and conservation of species. This will enable local actors to get the best value from their strong investments in RLTSs.

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