1 **Title: A robust goal is needed for species in the Post-2020 Global**
2 **Biodiversity Framework**
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4 **Running title:** A post-2020 goal for species

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Abstract

In 2010, Parties to the Convention on Biological Diversity (CBD) adopted the Strategic Plan for Biodiversity 2011–2020 to address the loss and degradation of nature. Subsequently, most biodiversity indicators continued to decline. Nevertheless, conservation actions can make a positive difference for biodiversity. The emerging Post-2020 Global Biodiversity Framework has potential to catalyze efforts to 'bend the curve' of biodiversity loss. Thus, the inclusion of a goal on species, articulated as Goal B in the Zero Draft of the Post-2020 Framework, is essential. However, as currently formulated, this goal is inadequate for preventing extinctions, and reversing population declines; both of which are required to achieve the CBD's 2030 mission. We contend it is unacceptable that Goal B could be met while most threatened species deteriorated in status and many avoidable species extinctions occurred. We examine the limitations of the current wording and propose an articulation with robust scientific basis. A goal for species that strives to end extinctions and recover populations of all species that have experienced population declines, and especially those at risk of extinction, would help to align actors towards the transformative actions and interventions needed for humans to live in harmony with nature.

73   1. INTRODUCTION

74   Human impact is driving a global increase in species extinction risk (the liklihood that a species

75   will go extinct; Díaz et al. 2019), an overall decline in species population abundance, and has led

76   to species' extinction rates (numbers of species extinctions over time) that are at least 10 - 100

77   times faster than natural background rates (IPBES 2019). The importance of reversing these

78   declines is not only recognized from an intrinsic perspective on the value of species persistence,

79   but also more broadly for the fundamental role that populations of species play in the functioning

80   of ecological systems and in the provision of ecosystem services on which humanity relies (Mace

81   et al. 2012). For these reasons, species conservation is written into the legislation of national and

82   sub-national jurisdictions, and features in many global policy conventions and commitments

83   (United Nations 2019).

84   The most notable global commitment to safeguard species to date has been Aichi Target

85   12 of the Strategic Plan for Biodiversity 2011-2020 (the 'Strategic Plan') under the Convention

86   on Biological Diversity (CBD) (Secretariat of the Convention on Biological Diversity 2011).

87   This states: "*By 2020, the extinction of known threatened species has been prevented and*

88   *their conservation status, particularly of those most in decline, has been improved and*

89   *sustained*". Yet, with ongoing declines in species populations, and many species facing

90   extinction, we have failed demonstrably to meet this target (Butchart et al. 2019;

91   Secretariat of the Convention on Biological Diversity 2020a).

92   With the Strategic Plan expiring in 2020, negotiations on the development of the Post-

93   2020 Global Biodiversity Framework under the CBD are now well underway. In January 2020,

94   the Zero Draft of the Post-2020 Framework (hereafter, the 'Zero Draft') was released, presenting

95   an opportunity for the global community to assess the potential strengths and weaknesses of the

96   proposed action plan beyond 2020 (Secretariat of the Convention on Biological Diversity

97   2020b).

98   For the duration of the Strategic Plan, almost all indicators of the state of biodiversity -

99   especially those relating to species - have continued to decline, thus increasing overall extinction

100   risk (Mace et al. 2018; Díaz et al. 2019; IPBES 2019). However, a substantial body of evidence

101   reveals that conservation actions, when well-planned and implemented, can stop species from

102   going extinct, slow the rate at which species are driven towards extinction, and halt and reverse

103   population declines (Simberloff et al. 2011; Hoffmann et al. 2015; Mace et al. 2018; Monroe et

104   al. 2019; Bolam et al. 2020). Therefore, if well-constructed, and in light of the biodiversity crisis

105   we are facing, the Post-2020 Framework could be extremely important for shaping policy and

106   directing efforts to halt species loss worldwide.

107   The Zero Draft proposes five outcome goals – three relating to different levels of

108   ecological organisation (ecosystems, species, and genetic diversity), and two reflecting the

109   contributions that biodiversity makes to people through its sustainable use and access and

110   benefit-sharing. To achieve these five goals, the framework proposes 20 action targets – an

111   appropriate and potentially powerful framework. Despite the strength of this framework,

112   however, we are concerned that the goal focusing on species (Goal B), as currently written

113   - "*The percentage of species threatened with extinction is reduced by [X%] and the abundance*

114   *of species has increased on average by [X%] by 2030 and by [X%] by 2050*" - carries serious

115   risk of failure. It is ambiguous, difficult to monitor, embeds the potential for unintended

116   outcomes, and is not sufficient to prevent extinctions and stabilize populations. It also

117   appears to be misaligned with other international agreements, and risks compromising the

118   achievement of the 2030 Mission and 2050 Vision of the Zero Draft itself. Recently, an

119   updated version of the Zero Draft, released in August 2020, proposes a reformulation of a

120   goal for species (Secretariat of the Convention on Biological Diversity 2020c). It is our

121   contention that this embeds the same flaws and risks as the species goal (Goal B) in the

122   initial Zero Draft, and is indeed a backwards step as species are no longer considered under

123   a dedicated, standalone goal. Thus, our critique of the original formulation of the goal for

124   species and the alternative we propose, is applicable to discussions about newer iterations

125   through this dynamic and ongoing process. There is still time before the Post-2020

126   Framework is finalized and our aim is to highlight three key problems with the species goal

127   and propose how it might be improved.

128   2.   ACCEPTING EXTINCTIONS AND EXACERBATING EXTINCTION RISK

129   Despite three decades of biodiversity policy commitments under the CBD, species continue to be

130   driven extinct. Aichi Target 12 in particular took a clear and bold stance on extinction,

131   stating that: "*By 2020, the extinction of known threatened species has been prevented….*"

132   Even so, during the 10-year period of nations acting to achieve Target 12, at least four

133   vertebrate species went extinct (IUCN 2020a). Further, over the last decade, overall levels

134   of extinction risk increased: while 22 species (in groups that have been comprehensively

135   assessed at least twice) improved in status sufficiently to qualify for down-listing to lower

136   categories of threat, more than six times that number (131 species) deteriorated in status

137   sufficiently to qualify for up-listing to higher categories of threat (Figure 1).

138   Goal B of the Zero Draft is a retreat from Aichi Target 12 regarding extinctions and

139   extinction risk, and could result in unintended outcomes. The proposed goal fails to

140   reiterate an explicit ambition to prevent further extinctions: "*The percentage of species*

141   *threatened with extinction is reduced by [X%]..*". In other words, contrary to Aichi Target 12,

142   the Zero Draft could be seen as accepting some human-induced extinctions. Indeed, as

143   currently written, Goal B could perversely be achieved by allowing species to go extinct,

144   thus reducing the number of species 'threatened' with extinction.

145   Furthermore, the proposed language in the Zero Draft's Goal B (*"The percentage of*

146   *species threatened with extinction is reduced by [X%].."*) is problematic for two reasons. First,

147   classification of species as threatened is binary, meaning that this measure is not very

148   sensitive, and does not reflect movement of species between the categories of Vulnerable,

149   Endangered or Critically Endangered (either as a consequence of improvements or

150   deteriorations in status). Hence, this element of the goal could be achieved solely by down-

151   listing a small number of Vulnerable species to Near Threatened or Least Concern (to

152   reduce the proportion of species threatened with extinction by X%), while potentially

153   allowing Endangered and Critically Endangered species to deteriorate in status further.

154   Such a perversity could draw attention and critical resources away from these species more

155   at risk of extinction, towards less threatened species, further imperilling Endangered and

156   Critically Endangered species.

157   Second, changes in the proportion of species threatened with extinction can, in part,

158   be explained by non-genuine reasons, for example through revisions in taxonomy,

159   reassessment of Data Deficient species, improved knowledge, and the addition of newly

160   assessed species in less well-known groups. Hence, each time the proportion is reported, it

161   would be necessary to communicate and explain changes in the baseline (2020) values for

162   the proportion too. While the Red List Index (Butchart et al. 2004, 2005, 2007) takes

163   account of non-genuine reclassifications to show trends in survival probability driven by

164   genuine improvement or deterioration in extinction risk, it cannot be simplistically

165   converted into trends in the percentage of species threatened with extinction.

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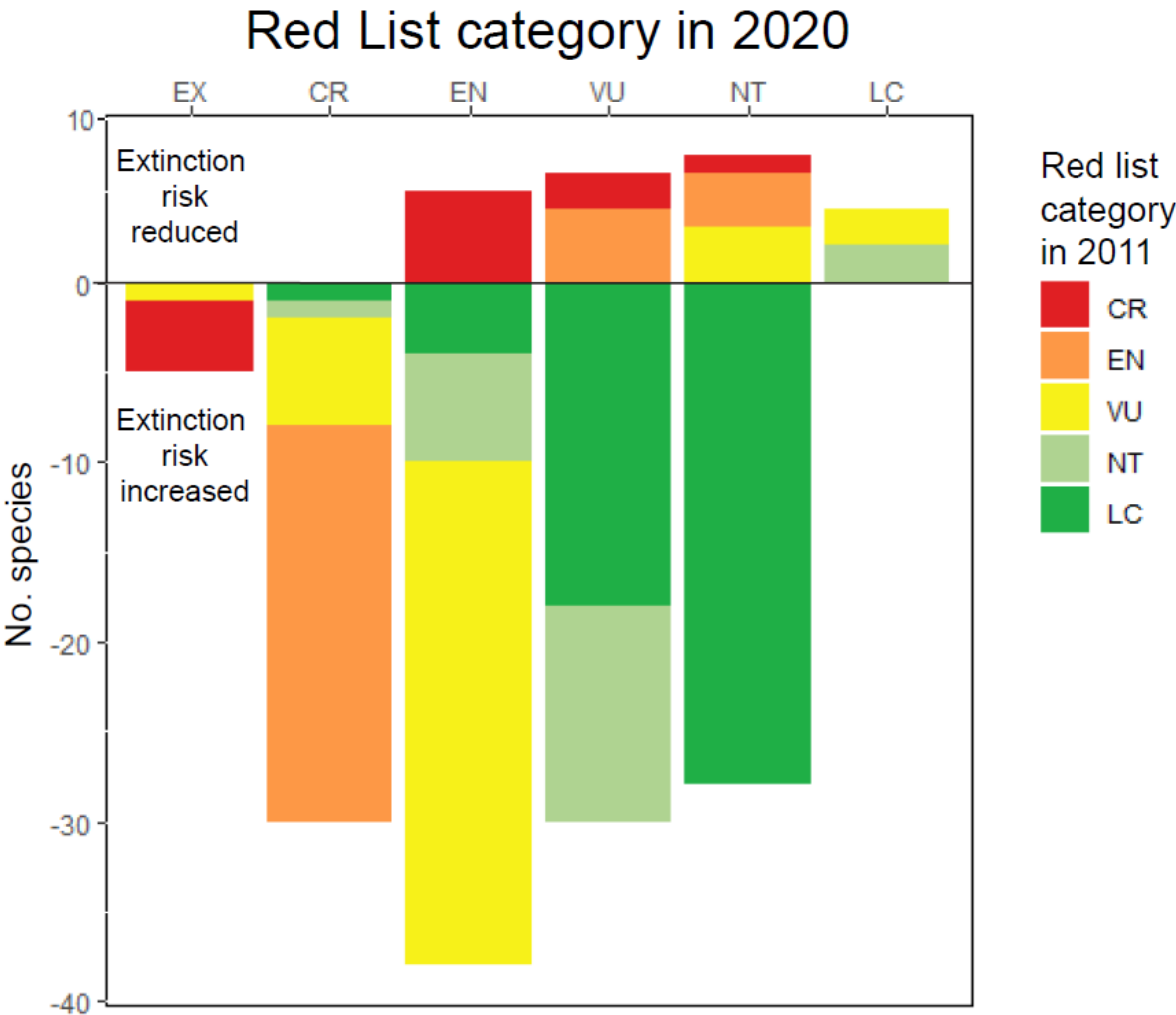
Figure 1. Since the Strategic Plan for Biodiversity 2011–2020 and its 20 Aichi Biodiversity

Targets came into force in January 2011, there have been nearly six times as many species that

qualified for up-listing to a higher category of extinction risk on the International Union for

Conservation of Nature (IUCN) Red List than qualified for down-listing to a lower category of

extinction risk. This figure is based on data from comprehensively assessed species groups

(birds, mammals, amphibians, corals, and cycads) and on genuine recategorizations (i.e.

173   excluding those resulting from improved knowledge, corrections, revised taxonomy etc.)

174   (Butchart et al. 2005; IUCN 2020b). For some taxa, the period between repeated Red List

175   assessments spanned the end of one decade and the start of the next (e.g. 2008-2012 for birds).

176   To account for this, we randomly sampled the relevant proportions of genuine changes to assign

177   to each decade (e.g. three-quarters of the genuine changes for birds from the period 2008-2012

178   were assigned to the decade 2000-2010, and one-quarter to the decade 2011-2020). This random

179   sampling was repeated 1000 times using a bootstrapping approach, and we used the mean

180   number of respective category transitions from these iterations to represent up-listings and down-

181   listings for each decade. The values for each taxon group were summed and plotted. IUCN Red

182   List categories EX = Extinct, CR = Critically Endangered, EN = Endangered, VU = Vulnerable,

183   NT = Near Threatened, LC = Least Concern. For illustrative purposes, Extinct here includes

184   species classified as Extinct in the Wild, or Critically Endangered and tagged as Possibly Extinct

185   or Possibly Extinct in the Wild. For limitations of the IUCN Red List, see the Monitoring

186   Progress section of the main text.

187

188   3. THE ABUNDANCE COMPONENT IS AMBIGUOUS

189   Functional increases in species' populations are fundamental to threatened species

190   recovery. Another essential aim of conservation is maintaining and where necessary

191   recovering the populations of species to prevent them from declining or becoming

192   threatened, given the key role they may play in the function of ecosystems and the delivery

193   of ecosystem services (Gaston 2010). Concern over population declines of invertebrates

194   (Sánchez-Bayo & Wyckhuys 2019), and common vertebrate species (Ceballos et al. 2017),

195   highlight the importance of including population abundance as a key component of any

196   species-focused goal.

197   However, the current wording of this element of the goal '*the abundance of species*

198   *has increased on average by [X%] by 2030 and by [X%] by 2050*' contains two unhelpful

199   ambiguities. First, 'abundance of species' can be interpreted as the number of species; the

200   appropriate terminology should be "population abundance of species". Second, the target

201   could be perversely met through facilitating increases in population abundance of invasive

202   alien species, while allowing native species to decline, so it is important to specify that the

203   focus is on native species.

204   4. OTHER OBJECTIVES ARE COMPROMISED

205   The Zero Draft's Goal B is currently misaligned with broader international and societal

206   goals. For example, Sustainable Development Goal 15 (Target 15.5) seeks to halt

207   biodiversity loss by 2030 (United Nations 2019), which does not accord with the currently

208   proposed species goal (Goal B). Additionally, as written, Goal B potentially conflicts with

209   other goals and action targets captured in the Zero Draft. For example, a direction of

210   resources towards Vulnerable species, allowing unabated declines in Endangered and

211   Critically Endangered species, could, in some cases, have adverse implications for the

212   function of ecosystems (compromising Goal A with its aim of no net loss of ecosystem

213   integrity) (Gascon et al. 2015). For instance, in Madagascar the extinction of 17 lemur

214   species and reduction in population of many others that are now highly threatened has had

215   a substantial impact on forest function through the loss of seed dispersal (Federman et al.

216   2016). Similarly, the Critically Endangered Lowland Gorilla (*Gorilla gorilla gorilla*) plays

217   an important role through the regular deposition of seeds in open canopy environments

218 where light is not a limiting factor for seedling growth and survival (Petre et al. 2013). Due

219 to their decline, forests devoid of large frugivores are thought to be strongly impacted

220 through changes in population dynamics of plants, leading to shifts in plant community

221 structure, composition and to reduced tree diversity (Petre et al. 2013). Human-induced

222 extinction of species, which is not prevented by Goal B, would also result in a loss of genetic

223 diversity (Spielman et al. 2004), contrary to Goal C. Reductions in populations and/or

224 extinctions will also reduce the benefits from the use of genetic resources through potential

225 missed opportunities for sustainable use (Goal D), or for new medicines or increased

226 scientific understanding (Goal E) (Luck et al. 2003).

227 Perhaps most importantly, Goal B does not align with the Zero Draft's own 2030

228 Mission "To take urgent action across society to put biodiversity on a path to recovery for

229 the benefit of the planet and people". Potentially compromising Critically Endangered and

230 Endangered species and allowing species to go extinct will not put biodiversity on a "path

231 to recovery". This also jeopardizes our ability to live "in harmony with nature", a key tenet

232 of the 2050 Vision.

233   5. AN IMPROVED GOAL FOR SPECIES

234 Given the limitations we identify for Goal B of the Zero Draft, we propose the following revised

235 wording for a species-focused goal in the Post-2020 Framework:

236 *"Human-induced species extinctions are halted from 2020 onwards, the overall risk of*

237 *species extinctions is reduced by 20% by 2030 and is zero by 2050, and the population*

238 *abundance of native species is increased on average by 20% by 2030 and returns to 1970*

239 *values by 2050."*

240   This revised goal takes the necessary bold stance on species extinctions (consistent with

241   Aichi Target 12) by stating "*Human-induced species extinctions are halted from 2020*

242   *onwards*". Even under Aichi Target 12, some extinctions occurred, but it is also clear that

243   conservation action prevented many more extinctions (Bolam et al. 2020). We argue that any

244   relaxation on the expectations of nations to prevent extinctions would be a failure in response to

245   the biodiversity crisis. We have specified 'human-induced' extinctions, as a tiny fraction of

246   extinctions may be caused by geological events (volcanoes, tsunamis, etc.) and other natural

247   events that are not feasible to mitigate (e.g. those events and perturbations that generate the

248   "background" rate of species extinction through the geological record). Additionally, we note

249   that some species may be considered at high risk of extinction through an "extinction debt"

250   owing to anthropogenic processes in recent history (Tilman et al. 1994). However, we contend

251   that beyond 2020, nations should aspire to halt and reverse the trajectory of even these most

252   imperilled species – a challenging undertaking, but one that is not insurmountable should the

253   transformative change that the Zero Draft calls for be embraced by Parties to the Convention. By

254   extension, we also suggest that even the species at highest risk of extinction can be recovered

255   with sufficient resources, improved understanding, and transformative change in the way we

256   manage the environment.

257   We interpret the CBD Vision for 2050 of living "in harmony with nature" to mean that no

258   known species is threatened with extinction. To achieve this vision by 2050, a demonstrable

259   reduction in extinction risk is required by 2030. The goal we propose requires a quantifiable

260   gauge for improvement by 2030 as a means by which to check whether we are "on the path

261   to recovery". As such, the revised goal we propose embeds and allows for the tracking of

262   global extinction risk: "*the overall risk of species extinctions is reduced by 20% by 2030*

263   *and is zero by 2050".* Given that extinction risk in comprehensively assessed groups

264   (mammals, birds, amphibians, corals and cycads) has increased by 4-5% per decade since

265   2000, we propose that reversing this trend, and further reducing extinction risk by 20% is

266   arguably an appropriate milestone towards eliminating human-induced extinction risk (and

267   by association, human-induced extinctions of species captured under the Red List) by 2050,

268   accepting that this will require substantial ambition and can only be achieved with

269   transformative change (as called for in the Zero Draft). Nevertheless, we recognise that

270   CBD Parties may opt for greater or lesser ambition by 2030 on the pathway to the 2050

271   vision. Importantly, achieving the milestone of an overall reduction in extinction risk of

272   20% by 2030 should be driven by improvements in species across all risk categories from

273   Near Threatened through to Critically Endangered and Extinct in the Wild. This is because

274   focussed efforts in the decade to 2030 to stabilise and recover a subset of threatened

275   species should not perversely lead to an increase in the extinction risk of other threatened

276   species, by, for example, diverting resources and attention away from them. We also note

277   that the reduction in extinction risk needs to be measured against the same set of species, as

278   is implicit in the Red List Index methodology (Butchart et al. 2007).

279   We propose as the third element of the goal: "*and the population abundance of native*

280   *species is increased on average by 20% by 2030 and returns to 1970 values by 2050".* This

281   specifies average abundance of all species populations (recognising that some population

282   declines for very common or overabundant species will be offset by increases in others,

283   and that we refer to the geometric mean of relative abundance across all species, so a small

284   increase in a common species will not compensate for a large decrease in a rare species)

285   and to native species (recognising that increases in invasive alien species are not desirable).

286 Increases in population sizes should occur only within or contiguous to (to allow for

287 climate tracking) the native ranges of species, and that such population

288 maintenance/increases be considered across all species that have experienced declines, and

289 not just those that are listed as threatened with global extinction. This element of the goal

290 aims to promote the overall recovery of depleted populations, and we recognise that

291 average population abundance is a crude, but pragmatic, means of quantifying this. It

292 should therefore be complemented by the establishment of specific targets for recovering

293 populations set on a species-by-species basis (e.g. at a national scale) relative to the

294 declines that they have experienced. Efforts should also be made to identify and target efforts

295 in particular on promoting population recovery for those species that play key ecosystem roles

296 and are of particular ecological significance. Average population abundance as measured by

297 the Living Planet Index has declined by 60% since 1970 (McRae et al. 2017), which is the

298 earliest time-point with sufficient data for global trends to be assessed. Therefore, we

299 suggest the aim should be to recover populations to at least their 1970 baseline, with "20%

300 by 2030" being a potential milestone for tracking progress, and larger proportional

301 increases required after 2030. We do note, however, that these targets should be iterative,

302 and revised over time as more information becomes available on historical abundances, and

303 demography of species.

304 　　　The release of the Zero Draft in January 2020 has already generated a great deal of

305 discussion and critique around what is needed for species in a post-2020 world (Secretariat

306 of the Convention on Biological Diversity 2020d). We suggest that the formulation of the

307 goal suggested here best addresses the deficiencies of the language proposed in the Zero

308 Draft, while capturing the key tenets of the various alternatives that have been proposed to

309   supersede it. Crucially, it is clear, measurable, avoids perverse incentives for unintended

310   outcomes, and embeds outcomes that are consistent with the Vision and Mission of the

311   Post-2020 Framework.

312   MONITORING PROGRESS

313   Progress towards the revised goal that we propose can be monitored and tracked at a global

314   scale using the International Union for Conservation of Nature (IUCN) Red List of

315   Threatened Species (for documenting extinctions), the Red List Index (for tracking levels

316   of extinction risk) and robust population indicators (for tracking average population

317   abundance), which were appropriately highlighted in the Zero Draft as key indicators for

318   measuring progress towards achieving Goal B (Secretariat of the Convention on Biological

319   Diversity 2020b). The Red List Index measures trends in overall species extinction risk,

320   based on population and range size and trends as quantified by IUCN Red List Categories

321   (Butchart et al. 2004, 2005, 2007). The 2030 goal would be achieved if the current Red List

322   Index value increased by 20% (as a Red List Index value of 1 equates to all species

323   qualifying as Least Concern, while an index value of 0 equates to all species qualifying as

324   Extinct). We suggest measures of extinction risk are used rather than extinction rate, to

325   allow for pro-active conservation action, and because extinction rate is difficult to measure

326   over relatively short periods of time. The abundance component of the revised goal can be

327   quantified using population indices, of which the best-known include the Wild Bird Index

328   (Gregory & van Strien 2010) and the Living Planet Index (Loh et al. 2005; McRae et al.

329   2017).

330   The Red List Index and established population indices are useful measures of

331 species extinction risk and abundance, and the former can be disaggregated for national

332 reporting (with this being possible for the latter where data allow). However, they have

333 limitations. Red List Categories are broad (reducing sensitivity), many species are

334 classified as Data Deficient (adding quantified uncertainty), and relatively few groups have

335 been comprehensively assessed multiple times for the IUCN Red List and hence included

336 in the Red List Index (limiting representativeness) (IUCN 2020a, 2020b). Meanwhile,

337 many of the input data for the Living Planet Index appear to be from populations measured

338 because they are known *a priori* to be declining, and so the indicator may not yield robust

339 insight into population trends of all species. The effects of combining population time

340 series from single sites, from portions of species ranges (e.g. countries), and from across

341 the entirety of species ranges are also unclear. Therefore, the effectiveness of these metrics

342 should be enhanced through greater monitoring of species populations (particularly in

343 countries with a disproportionate lack of information) and expanded numbers of species

344 regularly assessed for the IUCN Red List (thereby increasing its geographic and taxonomic

345 coverage, given that only 120,000 species have been assessed to date). Increasing the

346 frequency of reassessments for the IUCN Red List would also help to mitigate time-lags

347 before status changes are reflected on the IUCN Red List (Butchart et al. 2006). This

348 requires much more substantial investment in biodiversity monitoring than is currently the

349 case.

350   Other metrics of extinction risk and abundance may also be used and may be more

351 appropriate for regional and national scales (Buckland et al. 2017). For example, the most

352 robust measures of abundance are those based on structured samples across all populations

353   for given regions and taxonomic groups, like the Wild Bird Index (Gregory et al. 2019).

354   While effective, these are still highly restricted geographically and taxonomically.

355   Improved monitoring to underpin more rigorous, scalable indices will better allow us to

356   track progress towards achievement of the quantifiable elements of the revised goal that we

357   propose.

358   **Table 1** – Proposed species goal for the Post-2020 Global Biodiversity Framework broken
359   into each element, and how it can be monitored.

360

Component	Revised goal	Quantifiable indicator
Extinctions	*Species extinctions are halted from 2020 onwards*	IUCN Red List
Extinction risk	*...the overall risk of species extinctions is reduced by 20% by 2030 and is zero by 2050*	Red List Index
Abundance	*…. and the population abundance of native species is increased on average by 20% by 2030 and 60% by 2050"*	Population indices

361

362   We note that meeting this goal will require mitigating key threats to species. These

363   are, principally, unsustainable agriculture, unsustainable exploitation (including logging,

364   fisheries and hunting/gathering wild species), the negative impacts of invasive alien

365   species, pollution, commercial and residential development, and increasingly, climate

366   change (Maxwell et al. 2016; IUCN 2020a). The proposed action targets 1-6 in the Zero

367   Draft largely cover these actions. However, to prevent extinctions, recovery actions and

368   active interventions will be urgently needed for many of the most highly threatened

369   species, for which mitigating external threats alone will be insufficient to prevent their

370   extinction. Such species are frequently reduced to populations that are not demographically

371 or genetically viable, and so require emergency actions. Examples include translocation,

372 assisted colonization, captive breeding and release for animals and propagation for fungi

373 and plants, and targeted recovery actions such as supplementary feeding and breeding site

374 provision (Cochrane et al. 2007; Comizzoli & Holt 2019). Therefore, we recommend that

375 an additional target should be included in the Post-2020 Framework to promote

376 implementing emergency, proactive species recovery actions above and beyond threat

377 alleviation for those species whose survival and recovery requires such actions.

378 ## 6. CONCLUSION

379 The revised species goal we propose is ambitious, unambiguous, can be readily

380 communicated, and comprises quantifiable elements against which nations can transparently

381 measure their progress. Post-2020, we must halt any further extinctions, reduce the

382 extinction risk of those species that are threatened, and recover and maintain populations of

383 species in their native range at levels to ensure their survival and the continued functioning

384 of ecosystems. To be 'on a path to recovery' by 2030, and 'living in harmony with nature'

385 by 2050, we must take decisive action for biodiversity from 2020. A clear and adequate

386 goal for species conservation is fundamental to these efforts.

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