ICRI 1994–2019 25 YEARS IN PARTNERSHIP FOR CORAL REEFS

Australian Government
Great Barrier Reef Marine Park Authority

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Dear Ms Mrema

Subject: Response of the Co-Chairs of the International Coral Reef Initiative on Targets, indicators and baselines (notification 2019-108); and Linkages between biodiversity and climate change (notification 2019-115) on the basis of the Zero Draft of the Global Biodiversity Framework

1 The information in this note is submitted by the Co-Chairs of the International Coral Reef Initiative Secretariat (www.icriforum.org) in response to the SCBD notifications 2019-108 and 2019-115. As requested in the texts of these notifications, this submission provides input in three parts (sections 1 to 3 of this document as outlined below) and is provided in the context of the Zero Draft of the post-2020 Global Biodiversity Framework (CBD/WG2020/2/3) and the preliminary draft monitoring plan released on 13 January 2020.

> **Section 1**: Views on possible targets, indicators and baselines related to the drivers of biodiversity loss as well as on species conservation and the mainstreaming of biodiversity across sectors in relation to the development of the post-2020 global biodiversity framework (See also Annex 1 and Annex 2).
>
> **Section 2**: Specific Comments on CBD/SBSTTA/23/INF/4 "Indicators for global and national biodiversity targets – Experience and indicator resources for development of the post-2020 global biodiversity framework".
>
> **Section 3**: Views on possible targets and indicators for the post-2020 global biodiversity framework related to the inter-linkages and interdependencies between biodiversity and climate change as requested through notification 2019-115 responding to SBSTTA Recommendation 23/2.

2. The International Coral Reef Initiative (ICRI) is a partnership between Nations and organizations, which strives to preserve coral reefs and related ecosystems around the world by promoting sustainable management practices, building capacity, raising awareness and promoting action to address the continuing decline of coral reefs. ICRI was founded in 1994 and has more than 80 members, including 37 countries that are Parties to the CBD.

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3. Disclaimer: *Please note that this submission is provided as a contribution to the consultation process as a result of the work being undertaken by an ICRI ad hoc committee. It does not represent any agreed statement of policy by ICRI members, nor does the submission prejudice future negotiation positions.*

Yours sincerely
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1. Views on possible targets, indicators and baselines related to the drivers of biodiversity loss as well as on species conservation and mainstreaming of biodiversity across sectors - taking into account the Zero Draft of the Global Biodiversity Framework (WG2020/2/3)

1.1. General comment:

Coral reefs are identified by the IPCC in their assessments as a "unique and threatened ecosystem" [1] . They support food systems, economies, human health, connect marine systems, have important cultural significance and ensure the viability of traditional ways. Coral reefs support the economic opportunities of hundreds of millions of people in over 100 countries[2] and have a total net benefit of almost $30 billion per year[3].

Coral reefs are our "canaries in the coal mine" in this critical period between 2020 and 2030. Aichi Target 10 was not achieved and the urgency for addressing coral reef decline has intensified.

All recent global assessments show coral reefs to be of particular concern, including the Global Biodiversity Assessment published by IPBES in 2019. Almost 50% of living coral has been lost since 1870 and this loss is accelerating[4]. Coral reefs are however highly adaptive. More than 60% of the world's coral reefs are under immediate and direct threat from local stressors[5], the removal of which is critical for allowing recovery and building resilience of these systems and giving them a chance to adapt to changing climatic conditions. With the current rate of decline, we risk losing an irreplaceable source of food and economic opportunity. The window for action is narrow and closing.

The Post-2020 Global Biodiversity Framework, with its milestones through to a 2050 vision of living in harmony with nature, provides an important opportunity for focused strategic action to save coral reefs from further decline and extinction.

Overall, the structure and initial content within the Zero draft is encouraging and seems to provide for the type of actions that will be required to change the trajectory for coral reef related ecosystems.

Further clarification on the association and hierarchy is needed between the *Goals* and the *Action Targets* within the draft framework. The current clustering of Action Targets in the zero draft do not always appear to reflect the Goals.

1.2. Comment on the goals

Comments pertain in particular to Goals a, b, d(i), d(iii) and e, as these are most relevant to coral reefs, as a flagship ecosystem in the marine environment.

Biodiversity goal (a): *"No net loss by 2030 in the area and integrity of freshwater, marine and terrestrial ecosystems, and increases of at least [20%] by 2050, ensuring ecosystem resilience"*

The articulation of this goal is encouraging in that it would enable action that will address coral reef ecosystems. Given the evidence available for this ecosystem, however, the goal is probably over ambitious, but it is recognized that it is important to set the ambition level sufficiently high for all ecosystems. Clear

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[1] IPCC 2018 - https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-b y-governments/

[2] The Coral Reef Economy
https://wedocs.unep.org/bitstream/handle/20.500.11822/26694/Coral_Reef_Economy.pdf?sequence=1&isAllowed=y

[3] Conservation International 2008. Economic Values of Coral Reefs, Mangroves and Seagrasses.

[4] IPBES Global Assessment 2019 https://www.ipbes.net/news/Media-Release-Global-Assessment

[5] Reefs at Risk revisited https://pdf.wri.org/reefs_at_risk_revisited.pdf

interpretation of the goal will require agreement on the definition of terms (e.g. "area" "integrity", to which ecosystems does the goal apply to? All, important, at risk?). We do not provide any elaboration here, but encourage this clarity through the relevant working arrangements.

In relation to coral reefs, the following elements are particularly helpful:

- Inclusion of live coral cover as an indicator under this goal
- Including the concept of integrity – which has implications of function and ecosystem services provided to people.

The goal and explanatory text could be improved in the following ways:

- Reflect the need to avoid and minimize impact, through addressing local stressors;
- Make use of appropriate restoration in order to help achieve no net loss of area and integrity

Proposal for inclusion of sub-elements for Goal a:
We propose that Goal a should have sub-components, as is the case for Goal d. This would help to address those particularly vulnerable ecosystems for which there is evidence that this goal would not be feasible (e.g. perhaps a defined list of ecosystems that are particularly vulnerable to the impacts of climate change, such as coral reefs; arctic systems; tundra etc.). It could also be useful to consider some regional or national scale targets to enable this to be adapted to local contexts.

Biodiversity Goal (b) – *The percentage of species threatened with extinction is reduced by [X%] and the abundance of species has increased on average by [X%] by 2050*

>>The framing of this goal to include threat and abundance is helpful to take in keystone species, such as reef building corals.

Biodiversity Goal (d) (i) – *Nature provides benefit to people contributing to: Improvements in nutrition for at least [X million] people by 2030 and [Y million] by 2050.*

The inclusion of this sub-component is considered to be helpful.

>>Healthy, functioning coral reefs and associated ecosystems such as mangroves and seagrass beds play an important role in terms of provision of nutrition

- 70% of the protein in diets of Pacific Islanders come from reef-associated fisheries[6]
- coral reef fisheries support some six million people[7] and are worth $6.8 billion a year providing an average annual seafood yield of 1.42 million tonnes[8]

Biodiversity Goal (d) (iii) – *Nature provides benefit to people contributing to: Improvements in resilience to natural disasters for at least [X million] people by 2030 and [Y million] by 2050.*

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[6] Pacific-Australia Climate Change Science and Adaptation Planning Program https://www.pacificclimatechangescience.org/wp-content/uploads/2015/11/PACCSAP-factsheet_Ocean-Acidification.pdf

[7] A Global Estimate of the Number of Coral Reef Fishers. https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0065397&type=printable

[8] Reef Resilience http://reefresilience.org/coral-reef-fisheries-module/coral-reef-fisheries/importance-of-reef-fisheries/

The inclusion of this sub-component is considered to be helpful.

>> Coral reefs and associated ecosystems such as mangroves play an important role in coastal protection. A healthy reef can reduce coastal wave energy by up to 97%[9]. Globally $6 billion of built capital is protected from flooding by coral reefs. In a recent risk based valuation study the coastal flood risk reduction benefits provided by coral reefs in the US. The annual value of flood risk reduction was over 18,000 lives and $1.805 billion[10].

More information on this topic has been provided under Action Targets 6 and 9 in section 1.3 below.

Biodiversity Goal (e) – *The benefits, shared fairly and equitably, for the use of genetic resources and associated traditional knowledge have been increased by [X] by 2030 and reached [X] by 2050.*

>>Depending on how the goal develops through the negotiations, it may be relevant in the sense that there is a rich traditional knowledge associated with coral reefs, their management and sustainable use for a diversity of purposes.

1.3. Views on the proposed action targets

Proposals are made for a coral related sub-target under Target 1, and inclusion of coral –reef related elements under a number of other targets including Target 2, 4, 6, 8 and 9 (see Part 1 of this section). Relevance to action targets 5, 7 and 11 for coral reefs has been highlighted. (see Part 2 of this section) The inclusion of coral reef related indicators in the Zero Draft under action targets 1 and 6 are felt to be appropriate and very helpful.

PART 1: The main targets in the current structure where we wish to highlight relevance to coral reefs;

Target 1. *"Retain and restore freshwater, marine and terrestrial ecosystems, increasing by at least [50%] the land and sea area under* comprehensive *spatial planning addressing land/sea use change, achieving by 2030 a net increase in area, connectivity and integrity and retaining existing intact areas and wilderness."*

As an observation, it is not clear if this target is intended to sit within goal a. Goals and targets seem not to nest together. As proposed for Goal a, a regional component to this target could be useful to help implementation.

We are supportive of this broad ecosystem target, recognising that it is important that the framework remains simple and globally relevant. It could however be beneficial to find a way to highlight those ecosystems that make a unique contribution to biodiversity and the use of nature by people (e.g. primary forests, as mentioned in the preliminary draft monitoring framework). Coral reefs should also be flagged in terms of their disproportionate value for biodiversity and people and the immediacy of the threat to this ecosystem.

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[9] The Nature Conservancy https://www.nature.org/en-us/what-we-do/our-insights/perspectives/insuring-nature-to-ensure-a-resilient-future/?src=r.v_insuringnature

[10] Storlazzi, C.D., Reguero, B.G., Cole, A.D., Lowe, E., Shope, J.B., Gibbs, A.E., Nickel, B.A., McCall, R.T., van Dongeren, A.R., and Beck, M.W., 2019, Rigorously valuing the role of U.S. coral reefs in coastal hazard risk reduction: U.S. Geological Survey Open-File Report 2019–1027, 42 p., https://doi.org/10.3133/ofr20191027.

It is proposed that some emphasis is given to the need to connect management of land and sea in an integrated way. Land and watershed management have a direct impact on coastal ecosystems, including coral reefs.

It is suggested that the target is edited to reflect that it is not just a matter of having spatial planning in place, *but that this should be actively/effectively implemented.* Having of watersheds and inshore areas under effective spatial planning as in a 'ridge to reef' type of approach could enable conditions for reefs, mangroves and seagrass to recover and become more healthy, not withstanding climate change effects.

Coral reefs could also serve as a model for operationalizing the apex targets. Establishing a series of sub targets could do this - to illustrate, a coral reef related ecosystems sub target might look like this:

Sub target proposal: Development and implementation of comprehensive spatial plans to specifically address the anthropogenic pressures that affect coral reefs and other ecosystems that are most vulnerable to climate change, and ensure these ecosystems are effectively and sustainably managed to maintain area and ecosystem integrity, even when they are not within effectively managed MPAs/ OECMs.

Indicators: We support the inclusion of Live coral cover as an indicator under this target.

Additional indicators would be needed to measure integrity. Suggestions are provided in section 2.4. Integrity is closely linked with functionality and the provision of ecosystem services.

Target 2. *"Protect sites of particular importance for biodiversity through protected areas and other effective area-based conservation measures, by 2030 covering at least [60%] of such sites and at least [30%] of land and sea areas with at least [10%] under strict protection".*

Area based conservation measures are one of the key management actions for coral reef protection and recovery.

It is proposed that the target text could be improved by:

- Specifying the need for the protected areas to be effectively managed
- Having a an agreed definition for "of particular importance for biodiversity" (or referring to the existing agreed definition)
- Including a specific coral reef related indicator for this target.

  Indicator proposal: [area][%] of coral reefs under functioning marine protected areas and other effective area based conservation measures.

This indicator is considered feasible for application at the global scale and is in use at the national scale (see Table in Annex 1 for more information on readiness).

Target 4 – *"Reduce by 2030 pollution from excess nutrients, biocides, plastic waste and other sources by at least 50%".*

This target is very relevant for coral reef ecosystems, water quality is an important local pressure that must be addressed if Goal a is to be achieved for coral reefs, in particular with respect to excess nutrients and certain chemicals and plastic waste.

It is proposed that the word "chemicals" should be included in the target language. Of particular relevance to coral reefs and some other ecosystems is a class of chemicals called PBT's or persistent, bioaccumulative and toxic substances. These cover a range of substances including endocrine disruptors and they can also be associated with plastic and other debris. If "chemicals" is considered too broad a term, an alternative would be to add PBT's to the text of target 4.

The inclusion of pollution indicators (relating to eutrophication for example, and possibly others) are useful proxies for measuring coral reef health.

Inclusion of a suitable indicator for persistent, bioaccumulating and toxic substances (PBTs) would be very useful.

Target 6. *"Contribute to climate change mitigation and adaptation and disaster risk reduction through nature-based solutions providing by 2030 [about 30%] [at least XXX MT CO_2=] of the mitigation effort needed to achieve the goals of the Paris Agreement, complementing stringent emission reductions, and avoiding negative impacts on biodiversity and food security. "*

The inclusion of a coral-related indicators for this target are very much welcomed both for:

- Nature Based solutions (Number of people with reduced vulnerability due to NBS (e.g. coastal protection from mangroves, coral reefs) and;
- Resilience of biodiversity to the impacts of climate change (Reef Fish Thermal Index, Red List Index (reef-building corals), large reef fish)

In relation to the indicator concerning nature based solutions for adapting to impacts of climate change: As reflected under goal d(iii), coral reefs have an important role to play in shore line protection. The continued decline of coral reefs will have implications for disaster risk. At the current state of development of the Global Biodiversity Framework, it is unclear whether Target 6 or Target 9 would be the most appropriate place to highlight the potential of coral reefs as a Nature Based Solution to address impacts of climate change. Given the importance of this, in particular for island nations, it is included under both at this stage.

Coral reefs have been identified as one of 5 prominent areas of ocean-based climate change mitigation (with respect to coastal barriers to waves and storms)[11]. Ensuring the health and functioning of coral reefs is an important nature based solution for coastal protection and disaster risk reduction. Loss of coral reefs could increase risk to life and property for hundreds of millions of people (IPBES, 2019).

With regards to resilience, there is some promising indicator development to address at coral reef resilience at the ecosystem scale. These are likely to be ready in good time and feasible (see also Annex 1 and part 4 of this response for more information) these include

i. Red List of ecosystems (Coral reefs) – currently being developed for the Western Indian Ocean https://cordioea.net/research-assessment/innovating-and-sharing-knowledge-for-coastal-resilience-in-eastern-africa/rle/
ii. Carbonate budgets – as a proxy for understanding function – if the reef is accreting, eroding or static: Januchowski-Hartley Fraser A., Graham Nicholas A. J., Wilson Shaun K., Jennings Simon and Perry Chris T. Drivers and predictions of coral reef carbonate budget trajectories284Proc. R. Soc. Bhttp://doi.org/10.1098/rspb.2016.2533
iii. Measuring Structural complexity of coral reefs – looking at the variety of lifeforms on the reef as a proxy for resilience : Darling, E.S., Graham, N.A.J., Januchowski-Hartley, F.A. *et al.* Relationships between structural complexity, coral traits, and reef fish assemblages. *Coral Reefs* **36,** 561–575 (2017) doi:10.1007/s00338-017-1539-z

Target 8: *Conserve and enhance the sustainable use of biodiversity in agriculture and other managed ecosystems to support the productivity, sustainability and resilience of such systems, reducing by 2030 related productivity gaps by at least [50%]*

[11] Hoegh-Guldberg et al., (2019). The ocean as a solution to climate change http://dev-oceanpanel.pantheonsite.io/sites/default/files/2019-09/19_HLP_Report_Ocean_Solution_Climate_Change_final.pdf

The target is highly relevant for coral reef ecosystems in terms of coral reef fisheries, tourism, as well where there is management for multiple objectives (e.g. the Great Barrier Reef).

Coral reef fisheries support some six million people[12] and are worth $6.8 billion a year[13]. The current indicators however only focus on agricultural/ terrestrial production systems.

Coral reef tourism contributes $36 billion to the global tourism industry annually[14]

It is proposed that the indicator proposed under Target 2 could also be of use under this target ([area][%] of coral reefs under protected areas and other effective area based conservation measures).

Target 9 : *Enhance nature-based solutions contributing, by 2030, to clean water provision for at least [xx million] people*

There would be benefiting in broadening the scope of this target to cover nature-based solutions more broadly. If this was done, then it would be highly relevant to coral reefs as expressed under Targets 4 and 6 above.

PART 2: Comments on other targets that are relevant to coral reefs.

Target 5 - *"Ensure by 2030 that the harvesting, trade and use of wild species is legal and at sustainable levels"*

The term "wild species" as used here will need to be defined to clarify understanding of the target. This target will be relevant to the wide range of coral reef species that are harvested, traded and used. It is suggested that the target includes some wording to reflect the fact that some wild species are sufficiently rare and threatened that they should never be harvested or traded and should only be used in a non-extractive way (e.g. wildlife-watching). As currently worded, the target could be interpreted to mean that all wild species can be exploited provided this is legal.

Target 7: *Enhance the sustainable use of wild species providing, by 2030, benefits, including enhanced nutrition, food security and livelihoods for at least [X million] people, especially for the most vulnerable, and reduce human- wildlife conflict by [X%]*

This target is relevant to many coral reef fish species, but as with Target 5 should be worded to reflect the fact that some species should probably not be exploited for human use and should only be used in a non-extractive manner.

Often those individuals involved in the capture of wild species (e.g. in the live reef fish trade, trade in ornamental species) do not get a fair share of the value of the trade. Issues of equity, trade and transparency are important ensuring that the source countries and communities see increased benefits from sustainable use of wild species.

Target 11: *Ensure that benefits from the utilization of genetic resources, and related traditional knowledge, are shared fairly and equitably, resulting by 2030 in an [X] increase in benefits*

This target is relevant to coral reef ecosystems.

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[12] A Global Estimate of the Number of Coral Reef Fishers. https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0065397&type=printable

[13] Reef Resilience http://reefresilience.org/coral-reef-fisheries-module/coral-reef-fisheries/importance-of-reef-fisheries/

[14] Mapping the global value and distribution of coral reef tourism http://dx.doi.org/10.1016/j.marpol.2017.05.014

1.4. Views on indicators proposed in the draft monitoring framework

Document: Preliminary Draft Monitoring framework: CBD/WG2020/2/3/Add.1

This section provides views on the indicators already included in the preliminary draft monitoring framework for the zero draft; makes proposals for identified gaps and how these map out to the proposed structure; as well as suggestions for where indicators may provide proxy information for coral reefs.

Views on indicators proposed in the preliminary draft monitoring framework

The inclusion of the coral reef related indicators in the preliminary draft monitoring framework is welcomed and supported, as these are important indicators that are already in use in other processes and where there are frameworks in place to help facilitate the monitoring and data flows.

Having a well-designed monitoring framework will be of critical importance to be able to measure progress against the goals and targets, whilst not being burdensome. In the next section, we reflect on the gaps in the monitoring framework for being able to measure the proposed goals and targets and make proposals for indicators that are being used in the context of coral reef monitoring that could fill these gaps.

Consideration of other indicators relating to coral to fill gaps

There are a number of gaps in the preliminary draft monitoring framework, especially with regards to being able to measure both the area and integrity of ecosystems as well as their connectivity and resilience (required for Goal a and Target 1).

With respect to coral reef ecosystems there is already a framework in place for developing indicators to address these gaps, including through the GOOS/ Essential Ocean Variables process. The ICRI/ Global Coral Reef Monitoring Network (GCRMN) is actively involved in this process and will be using a number of these indicators in its forthcoming report on the status and trends of the world's coral reefs, 2020 due to be published in the coming months. There are also other organizations (including WCS) working to build capacity for coral reef monitoring and also using possible indicators.

It is also worth noting that with the UN decade of ocean science, action on Agenda 2030 and the post-2020 targets, improvements in monitoring could be very rapid, so its advocated that an approach to promote a hierarchy of indicators with variable resolution is taken, and some work on this is presaged in a coral reef Community White Paper presented at the OceanObs 2019 conference[15] and planning within the GCRMN and the GOOS Biology and Ecosystems Panel[16].

Indicators at the global scale:

In addition to Live coral cover, **Algae cover** and **fish abundance** are two indicators that can provide more information on the health and function / integrity of coral reefs. These are Essential Ocean variables and will be used for the 2020 Status report by GCRMN (see Annex 1 for more details)

Other indicators that are considered to be ready for use and will be critical for understanding elements such as integrity/ resilience include the following. More information is provided in Annex 1.

[15] Obura DO, et al. (2019) Coral Reef Monitoring, Reef Assessment Technologies, and Ecosystem-Based Management. Front. Mar. Sci. 6:580. doi: 10.3389/fmars.2019.00580

[16] GOOS Pegasus project, final report and outputs in preparation - http://goosocean.org/index.php?option=com_oe&task=viewEventRecord&eventID=2577

- Percent cover of key benthic groups
- Fish abundance
- [Percentage/ area] of coral reefs included in [effectively managed] MPAs and OECMs

Indicators we see as being important, and available but now need application at the global scale:

- Structural complexity of coral reefs
- Hard coral genera richness
- Red list of ecosystems (coral reef ecosystems)
- Number of threatened reef fish or invertebrates according to the IUCN red list

Indicators included in the preliminary draft monitoring program that could provide useful information as a proxy for coral reef health

A number of pressure indicators that are used for other targets but could be used as proxies for understanding and reporting on reef health have been identified in Annex 2.

Other notes relating to the Monitoring framework.

The existing mechanisms, capacity and cost of collecting data are important considerations when selecting indicators for the monitoring framework. For coral reef ecosystems:

- There are existing methods/ protocols for monitoring.
- GCRMN[17] is a global network for coordinating monitoring at the national, regional and global scale and could help in monitoring progress towards coral related indicators and targets.
- Monitoring capacity is patchy in time and space, addressing this issue is included within the adopted GCRMN Implementation and Governance Plan[18].
- Development is on-going within the GCRMN to establish data standards for coral reef monitoring as well as data tools such as MERMAID[19] to help enable researchers record their data in a way that will increase its usefulness for collating for indicator assessment.
- Innovation: Rapid progress is being made to harness new and emerging technologies that will make stepwise and possibly dramatic improvements to coral reef monitoring and facilitate improved policy decisions and management actions within the coming decade. Examples include the increased use of robotics and Artificial Intelligence, high-resolution imagery (e.g. the Allen Coral Atlas; underwater robots developed by AIMS). How will the Global Biodiversity Framework be able to take these developments up as they become available?

1.5. Baselines

The Global Coral Reef Monitoring Network (GCRMN) report on the status of coral reefs which will be published in 2020. One year after the beginning of the project, the data acquisition phase is almost complete, gathering more than 133 datasets on coral reef benthic cover. These datasets correspond to 50 countries and more than one thousands of locations spanning for more than 30 years.

[17] GCRMN https://gcrmn.net

[18] https://gcrmn.net/about-gcrmn/igp/

[19] MERMAID https://datamermaid.org/about/

This report may provide a global baseline for coral reef condition, as well as giving the most updated assessment of quality and coverage of data for any earlier baseline date to be selected.

A 2020 global extent layer for coral reefs is expected via the Allen coral atlas[20].

It is however important to note, that using a 2020 baseline will represent an already altered state, where 50% of reefs have been lost. It is true to say that whatever date is chosen, there will be the issue of a shifting baseline. This must be acknowledged in how the results are reported.

For coverage of coral reefs in protected areas with respect to Target 2, the baseline can be set using UNEP-WCMC's Protected Planet.

[20] Allen Coral Atlas: https://allencoralatlas.org

2. Comments on CBD/SBSTTA/23/INF/4: Indicators for global and national biodiversity targets – experience and indicator resources

C) Potential for the development of new indicators

- Suggest the use of existing and/ or development (if feasible) of one or two new indicators for a coral reef target, particularly focusing on the pressures on reef systems such as pollution and fishing;
- Indicators that are able to provide information on the function and resilience of a coral reef system are also being developed (see Table 2 in section 2 and also Section 4)
- However, such development should take into account the applicability / scalability of any new indicator according to agreed criteria e.g. as developed by the IAEG-SDG and the UNESCO GOOS/Essential Variable frameworks.
- Where possible, the incorporation and use of new and emerging technologies to support/improve the monitoring of new or existing indicators is encouraged.
- The development of three dimensional indices will be necessary to take into consideration the architectural complexity of the reef – this is important in the context of functionality of reefs. New 3D technologies will make these approaches easier.

D) Additional considerations for identifying indicators for the post-2020 global biodiversity framework

With regards to the proposal in Table 1 for a Limited set of fixed indicators vs Flexible framework of indicators

- It is important to be able to compare indicators and so support the use of having at least a minimum set of fixed/headline indicators for use at the sub-global and global levels. To enable this we strongly agree that it is important to put in place the necessary mechanisms and capacity at multiple levels in order to produce robust indicator data.
- With additional "supplementary indicators" that may be selected if particular Parties have the means to implement.
- However, many of the indicators that are already in use are not sufficient to measure progress against the targets being proposed. It is also important to create support/ momentum to continue developing indicators over time in order to fill gaps (thematicall and geographically)

3. Targets and indicators related to the inter-linkages and interdependencies between biodiversity and climate change

§ References relate to SBSTTA/REC/23/2

1. Coral reefs ecosystems can be seen as the canary in the coalmine – a clear demonstration of the interlinkages between biodiversity and climate change and precursor of impacts on other systems. It is critical for coral reefs that these interlinkages and interdependencies are recognized and incorporated into the design and implementation of the GBF, if it is to succeed.

2. The interactions between climate change and other drivers such as land/sea use change, overexploitation of resources, pollution, invasive alien species are complex and may exacerbate impacts on ecosystems – particularly coral reefs[21].

3. Climate change impacts on coral reef ecosystems are multifaceted (marine heat waves, acidification) affecting food and nutrition, coastal protection, opportunities for diversity in livelihoods, social and economic implications, impact on cultures and viability of traditional ways as well as ecological implications not only for coral reefs[22].

4. Ensuring the health and functioning of coral reefs is an important nature based solution for coastal protection, disaster risk reduction. Loss of coastal habitats and coral reefs reduces coastal protection, which increases the risk from floods and hurricanes to life and property for the 100 million to 300 million people living within coastal 100-year flood zones[23]. Coral reefs identified as one of 5 prominent areas of ocean based mitigation (wrt coastal barriers to waves and storms)[24].

5. The reports supported in the proposed draft decision of Recommendation 23/2 (§12) all make clear, urgent statements regarding coral reef status and health including with respect to climate change (IPCC special report on the impacts of global warming above 1.5 degrees; IPBES and IPCC Special report on ocean and the cryosphere in a changing climate). Coral reefs are identified as one of the "Unique and threatened ecosystems" (Reason for concern 1 – RFC1)[25] and Live coral cover is an example of the major historic losses in ecosystems and continuing declines highlighted by IPBES (2019).

6. §5 of Recommendation 23/2 refers to the Metz Charter on biodiversity from the G7 ministers in May 2019. The International Coral Reef initiative as a unique partnership and mobilizing diverse stakeholders concerned with coral reefs, was identified by the G7 Environment Ministers, as part of the tangible solutions for addressing major pressures on biodiversity.

7. Resilience – climate change impacts on coral reefs – as with other systems will not be homogeneous in intensity or timing. Understanding the variation in resilience – sources, corridors and sinks between coral reef ecosystems is very important.

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[21] IPBES, 2019: Key message B2; and draft GEO5 Summary for decision makers CBD/SBSTTA/23/2/Add.3 https://www.cbd.int/doc/c/bba0/d84c/e02639e37191f353553e513d/sbstta-23-02-add3-en.pdf

[22] The expected impacts of climate change on the ocean Economy (http://www.oceanpanel.org/expected-impacts-climate-change-ocean-economy]; and IPCC, 2019 SROC A6.4; B8.2

[23] IPBES (2019): Key message A3

[24] The ocean as a solution to climate change http://dev-oceanpanel.pantheonsite.io/sites/default/files/2019-09/19_HLP_Report_Ocean_Solution_Climate_Change_final.pdf (Hoegh-Guldberg et al., 2019)

[25] IPCC, 2018 – 1.5 degree report

8. Restoration efforts undertaken appropriately as part of a broader management intervention can be locally effective to enhance ecosystem-based adaptation IPCC, 2019 – SROC C2.2).

9. The inclusion of resilience in the proposed Goal a in the Zero Draft is a helpful inclusion to be able to make the linkages to climate change drivers. Targets/ indicators need to focus on resilience and encouraging actions that manage for resilience of the ecosystem.

10. Proposal for Indicators – new indicators will be needed to measure resilience more from a systems perspective. Here are some examples of these types indicators (currently in development):

i. Red List of ecosystems (Coral reefs) – currently being developed for the Western Indian Ocean https://cordioea.net/research-assessment/innovating-and-sharing-knowledge-for-coastal-resilience-in-eastern-africa/rle/
ii. Carbonate budgets – as a proxy for understanding function – if the reef is accreting, eroding or static: Januchowski-Hartley Fraser A., Graham Nicholas A. J., Wilson Shaun K., Jennings Simon and Perry Chris T. Drivers and predictions of coral reef carbonate budget trajectories284Proc. R. Soc. Bhttp://doi.org/10.1098/rspb.2016.2533
iii. Measuring Structural complexity of coral reefs – looking at the variety of lifeforms on the reef as a proxy for resilience : Darling, E.S., Graham, N.A.J., Januchowski-Hartley, F.A. *et al.* Relationships between structural complexity, coral traits, and reef fish assemblages. *Coral Reefs* **36,** 561–575 (2017) doi:10.1007/s00338-017-1539-z
iv. Indicators of key stone species, biomass of functional groups (herbivores and carnivores and Red List of threatened reef fish and invertebrate species.

ANNEX 1 – A prioritized list of indicators relating to coral reef ecosystems that are proposed for filling gaps

These additional Indicators are prioritized as follows:

Table 1: Indicators that are available, in use and ready for global application – proposed as essential for the Global Biodiversity Framework

Table 2: Indicators that are also relevant, but are not yet widely comparable or specific to locations.

Table 3: Indicators that are really interesting and we want to see developed - but not yet sufficiently ready to be used in 2020/ 2021

Table 1: Essential indicators: in use and globally comparable

Indicator	Purpose(what does it measure)	Goal or Target that it contributes to	Level of readiness	Examples of use (global, regional, national, local)	Notes/ description/ global relevance.
Percent cover of key benthic groups	This helps understand the entire benthic community. of a coral reef, and not just the % cover of hard coral and therefore function	Goal a Goal diii Target 1 Target 4? Target 6	In use	Draws indicators already in use by GCRMN, Essential Ocean Variables, CBD and proposed in the Zero Draft	Temporal monitoring of the different benthic categories (hard living corals, macroalgae, coral algae, turf, sponges, etc.) rather than simply the coral or algal cover. With coral reef ecosystems expected to erode beyond functioning levels in the coming decades without climate action and local management, understanding how shifts to different reef communities is important to predict ecosystem services and sustainability to people. Monitoring Based on standard Under water Visual Census (UVC) methods of point intercept transects, line intercept transect, photo quadrats, etc. Typically on UVC surveys, % cover of macroalgae, turf algae, cyanobacteria, soft coral, etc. is recorded.. This provides a lot of additional information on reef ecology without increasing the workload or the cost of monitoring.
Fish abundance	Important for looking at herbivore and carnivore abundances which are	Goal a Target 1 Goal di Target 5?	In use	GCRMN (2020 Status report)	Focus on abundance of some species, e.g. commercial species that most likely to be affected by human predation. Like I think that large herbivores and large

	heavily impacted in exploited reefs	Target 8		Essential Ocean Variable	carnivores are sufficient and should be targeted as indicators. Requires trained observers – although a few large species are easy to learn. Whilst biomass may be a better indicator than abundance, but few programmes record size class well enough to calculate biomass for large spatial scales.
Percentage of coral reefs included in MPAs [OEMCs]		Target 2	In use	French national indicator Global - Ocean + habitats dashboard	Percentage of warm-water corals that occur within a marine protected area – currently 40% https://habitats.oceanplus.org/#coralreef This is not sufficient without a measure of effectiveness

Table 2: Secondary and specific indicators: i.e. those that are relevant, yet not yet globally applicable

Indicator	Purpose(what does it measure)	Goal or Target that it contributes to	Level of readiness	Examples of use (global, regional, national, local)	Notes/ description/ global relevance.
Structural complexity of coral reefs	identify whether the reef architecture is architecturally complex and likely 'functioning' or whether it is flat and related to a lower productivity/disturbed reef.	Goal a Target 1			Based on a standard Underwater visual census scoring system This is proposed as a good and feasible alternative to coral species abundance.
Hard coral genera richness	But it is one of the only ways to understand coral community change and function	Target 1			Based on standard UVC methods of point intercept transects, line intercept transect, photo quadrats, etc. This indicator does rely on more advanced underwater identification skills, and may not be appropriate for all government monitoring agencies, etc. Genera-level IDs can be aggregated into broader functional groups. This could also relate in the monitoring framework to 'Trends in the resiliency of

					biodiversity to the impacts of climate change', considering how climate-sensitive or potentially climate-tolerant coral are changing.
Red list of ecosystems (Coral reef ecosystems)		Goal a Target 1	In development		Currently at regional scale WIO
Number of coral reef sites that are sustainably managed and used		Goal d			e.g. for marine tourism Similar to the proposed indicator for MPAs
Number of threatened reef fish or invertebrates according to IUCN Red List		Target 5 Target 7			

As a second tier, other variables currently being implemented at certain sites and providing important information on coral reef health at smaller scales include:

- coral recruitment rate (number/m2)
- coral bleaching (% by number of colonies, or by area)
- coral diseases (by named disease and prevalence)
- rugosity (relating to the architecture of the reef)
- invertebrate and/or other resource species (abundance/density)
- pest species (abundance/density)

Table 3: Interesting indicators in development that would warrant further attention in the coming implementation period

Indicator	**Purpose(what does it measure)**	**Goal or Target that it contributes to**	**Level of readiness**	**Examples of use (global, regional, national, local)**	**Notes/ description/ global relevance.**
Coral reef carbonate budgets	Could give information on functionality of reefs	Goal a Target 1 Target 6 or 9		Has been applied in the Caribbean	This is a very interesting indicator, but it remains to be seen how expensive the monitoring is.
Cumulative human pressure		Goal a Target 1			This would be very useful to include for coral reefs, but it

					remains to be seen how this will be measured in practice
Seagrass bed cover			In development by UNEP-WCMC		to tie in with live coral cover and mangrove cover for these three closely associated ecosystems
Reef fish biomass	globally relevant indicator of coral reef integrity, function, health		In use	GOOS – Essential Ocean variable	Validity broadly agreed. Monitored in-situ Requires measurement of: 1) the abundance of fish and 2) their size. This indicator builds on the fish abundance indicator, but there are some difficulties with implementation as few programmes record size class well enough to calculate biomass for large spatial scales. Use is dependent on improving the quality and comprehensiveness of existing monitoring – not starting anything new.
Grazing intensity	Proxy to estimate the status and functionality of the reef	Goal a, Target 1			Can be approximated with measures of fish population structure and biomass

ANNEX 2: pressure indicators that could be used as proxies for coral reef health

Indicator	Target	Current Monitoring element	Proposed Target monitoring element	Notes
Index of coastal Eutrophication and floating Plastic debris density	Target 4	Change in the impact of pollution on biodiversity.		Suitable for pollution / coral proxy?
Water clarity	Target 4			Also a proxy for water quality
Mean fish size per species (for important fish species, in terms of commercial interest, nutrition and food security) and relative to size of sexual maturation (proxies can be used for this)	Target 5			To give a change in the health of fisheries. Alternative to "proportion of fish stocks within biologically safe limits as this is very difficult to evaluate for coral reef fisheries.
Include Parameters related to ocean acidification such as pH, alkalinity, CO^2				Certain Physical-chemical parameters such as temperature, salinity and PH are very relevant and interesting for coral reef health.
Waste water treatment rate	Goal a Target 4.			Ideally 100%. Could be very informative about the efforts to be made by coral countries to improve their sewage facility and reduce pressure on coral reefs