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Matters for consideration or action by the Conference of the Parties: mercury and the Kunming-Montreal Global Biodiversity Framework

Analysis of the mutually supportive implementation of the Minamata Convention on Mercury and the Kunming-Montreal Global Biodiversity Framework

Note by the secretariat

1. In decision MC-4/12, the Conference of the Parties to the Minamata Convention on Mercury took note of the study on interlinkages between the chemicals and waste multilateral environmental agreements and biodiversity,[1] and emphasized that the implementation of the Convention contributed to the achievement of the Sustainable Development Goals and to addressing the triple planetary crisis of pollution, biodiversity loss and climate change.

2. In the same decision, the Conference of the Parties requested the secretariat to continue gathering knowledge about, raising awareness of, and demonstrating the contribution of the implementation of the Minamata Convention to other relevant international regulations and policies, including those related to biodiversity, and to prepare a report on how the Convention could contribute to the post-2020 global biodiversity framework, once adopted, for consideration by the Conference of the Parties at its fifth meeting.

3. In December 2022, the Kunming-Montreal Global Biodiversity Framework was adopted at the fifteenth meeting of the Conference of the Parties to the Convention on Biological Diversity, in its decision 15/4. The Framework sets out a pathway for reaching, by 2050, the global vision of a world living in harmony with nature, in which biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people.

4. To give effect to decision MC-4/12, with generous financial support from Norway and Sweden the secretariat engaged the services of a consultant to conduct a desk study and prepare a report on how the implementation of the Minamata Convention could support the Global Biodiversity Framework. The resulting report, entitled "The Minamata Convention on Mercury and the Kunming-Montreal Global Biodiversity Framework – mapping opportunities for generating co-benefits through coherent implementation", is set out in the annex to the present note, without formal editing.

* UNEP/MC/COP.5/1.

[1] UNEP/BRS/MC/2021/2.

Annex*

The Minamata Convention on Mercury and the Kunming-Montreal Global Biodiversity Framework – mapping opportunities for generating co-benefits through coherent implementation

* The annex has not been formally edited.

Contents

Summary

The objective of this report is to analyse, in response to decision MC-4/12, how the implementation of the Minamata Convention can contribute to the Kunming-Montreal Global Biodiversity Framework (GBF) and to identify opportunities for coherent and mutually supportive implementation to generate co-benefits for the GBF and the Minamata Convention. The report was made possible through the generous financial contribution of the governments of Norway and Sweden.

The Kunming-Montreal Global Biodiversity Framework (the "GBF") was adopted by the Conference of Parties to the Convention on Biological Diversity ("CBD"), at its fifteenth meeting (COP 15), which was held in December 2022 in Montreal, Canada. The GBF sets out an ambitious pathway to galvanize urgent and transformative action by Governments, and subnational and local authorities, with the involvement of all of society, to reach the global vision of a world living in harmony with nature by 2050 where "*biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people*".

The methodology of the study underpinning this report consisted of literature review focusing on scientific literature and national submissions under both conventions (national reports and action plans) that enabled the identification of entry points for joint action, as well as identification of possible indicators for follow-up.

Five core provisions of the Minamata Convention were identified as possible entry points for enhancing the contribution to and from the GBF. They are:

(a) Assessment of impacts of mercury on the environment (Art. 19.1c)
(b) Assessment of social, economic and cultural impacts, particularly in respect of vulnerable populations (Art. 19.1c)
(c) Artisanal and small-scale mercury mining (Art. 7)
(d) Monitoring the presence and movement of mercury in the environment (Art. 22.2 and Art. 19.1b)
(e) Remediation of mercury contaminated sites (Art. 12)

The analysis showed links of the Minamata Convention to 21 GBF Targets. Opportunities to generate co-benefits included, for example, action towards the use of mercury in ASGM, monitoring of mercury in the environment, harnessing the contribution of Indigenous Peoples and local communities[1] to fight biodiversity loss and mercury pollution. For each of the relevant GBF Targets, examples of possible activities and interventions were identified that could generate co-benefits to the Minamata Convention and the GBF. They include:

[1] The report follows the use of the term "local communities" used by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) to refer to non-indigenous communities with historical linkages to places and livelihoods characterized by long-term relationships with the natural environment, often over generations.

Target 1 – Spatial planning[2]

- Identify areas of high-biodiversity value that also act as sources of methylmercury production and export as priorities for integrated and biodiversity inclusive spatial planning.
- Focus efforts on controlling emissions and releases from sources of mercury that pose risks to areas of high biodiversity importance. One approach could involve creating "buffer areas" that are more closely monitored.
- Cooperate with Indigenous peoples and local communities to effectively prevent, control and avoid adverse effects of mercury in areas of high biodiversity importance.
- Integrate mercury control measures into revised and updated national biodiversity strategies and action plans (NBSAPs) in accordance with CBD decision 15/6 and aligned with the GBF Goals and Targets.
- Integrate biodiversity positive action into the development and implementation of national action plans (NAPs) on ASGM in accordance with Art. 7 and Annex C.

Target 2 – Restoration

- Implement mercury control measures, including but not limited to those under Art. 12, and demonstrate the benefits of restoration of mercury-contaminated sites for biodiversity and ecosystem functions and services, as well as how achievements under GBF Target 2 can contribute to the objective of the Minamata Convention.
- Identify suitable and cost-effective methods for scaling up restoration of contaminated sites (e.g., through phytoremediation that uses natural processes and the abilities of plants to absorb and remove contaminants).
- Reduce stress on reproductive success caused by mercury exposure in relevant species (e.g., creating mercury-free nesting areas for threatened turtles).
- Ensure that priority mercury-contaminated ecosystems, such those that act as sources of MeHg and are of high biodiversity importance (e.g., wetlands), are identified and restored.
- Train and create incentives for ASGM miners to rehabilitate abandoned mining sites.

Target 3 – Protected areas

- Assess the extent of ASGM activities in which mercury is used and combine phasing out the use of mercury in ASGM with activities that enhance the conservation and sustainable use of areas of particular importance for biodiversity and ecosystem functions and services.
- Mainstream mercury control measures into conservation policies to improve the sound management of the ASGM sector.
- Use airborne and satellite monitoring techniques to assess the extent of ASGM activities, including associated deforestation.
- Conduct biodiversity risk assessments to determine which areas and species are most at risk from mercury pollution.
- Uphold the rights of vulnerable populations, including Indigenous peoples and local communities, to an environment free of pollution and enforce legislation to prevent and combat ASGM activities taking place on Indigenous territories without the consent of the affected Indigenous communities.

Target 4 – Species extinction

- Increase monitoring of species impacted by mercury to inform the development of possible management action to mitigate the effects.
- Support coherent national- and sub-national level implementation of the Minamata Convention and other relevant MEAs, as appropriate, such as the:

  i. Convention on Biological Diversity on relevant programmatic areas and in the monitoring of the GBF Targets;

[2] The full text of the GBF targets is shown in Table 5.

ii. International Convention for the Regulation of Whaling on the monitoring mercury levels in cetacean species;

iii. Convention on Migratory Species on the impact of mercury on migratory species and on how animal migration contributes to the global transport of mercury;

iv. Ramsar Convention on Wetlands to map wetlands of international importance that are at increased risk of mercury pollution.

Target 5 – Safe use of wild species

- Support efforts to evaluate mercury exposure pathways and impacts on vulnerable populations, including of Indigenous peoples and local communities, that rely on the sustainable use, harvesting and trade of wild species to support decision-making to better protect their health and livelihoods.
- Raise awareness of the risk of mercury toxicity from the consumption of certain wild species among vulnerable populations.
- Integrate mercury control measures into approaches that aim at achieving optimal health outcomes recognizing the interconnection between people, animals, and their shared environment (e.g., One Health approaches).
- Conduct socio-economic studies to assess the impact of mercury pollution, for example, for communities that rely on artisanal fisheries for their livelihoods.

Target 6 – Invasive alien species

- Monitor the level of mercury in fish and other invasive species that may lead to increased mercury exposure in humans, especially before any eradication and control efforts that promote consumption of invasive species by humans or farmed animals are put in place.
- Promote and support research on the impacts of invasive alien species on methylmercury production and food webs.

Target 7 – Pollution

- Support full implementation of control provisions of the Minamata Convention and undertake actions described throughout this document, all of which are relevant to the achievement of Target 7.
- Align monitoring efforts under the Minamata Convention and GBF by including, in the Monitoring Framework of the GBF, a component indicator related to mercury under a headline indicator related to highly hazardous chemicals.
- Report on the implementation of strategies to reduce and eliminate the emissions and releases of mercury into the environment, with a focus on the main polluting sources and processes (e.g., by reducing mercury use in ASGM and mercury-added products) and improving recovery and environmentally sound disposal of by-product mercury (e.g., from large-scale mining, coal burning, and other industrial processes).
- Promote research on the risks and impacts of mercury on ecosystem functions and services and the impacts of degraded ecosystems on mercury cycling.
- Promote and support research in wildlife toxicology and mercury monitoring to better predict and assess the risks of mercury pollution to biodiversity and inform the development of policy to reduce emissions and releases.
- Contribute and support the effectiveness evaluation of the Minamata Convention, including through the development of temporal trends of mercury in the environment and the development of risk modelling.
- Conduct risk assessments of the cumulative effects of mercury and other highly hazardous chemicals.

Target 8 – Climate change

- Support full implementation of control provisions of the Minamata Convention with respect to mercury use in industrial processes and mercury emissions control, with direct relevance and co-benefits to climate change.

- Promote research and cooperation to improve understanding of, and to identify possible actions to mitigate the impacts of climate change and ocean acidification on mercury cycling, long-range transport and environmental fate, and the associated contribution to biodiversity loss.

Target 9 – Sustainable management and use of wild species

- Mainstream coherent mercury and biodiversity action into national policies.
- Engage Indigenous peoples and local communities to reform the ASGM sector and, where appropriate, combat illegal ASGM activities to improve the sustainable management and use of wild species, while enhancing the social, economic and environmental benefits for people. Examples of initiatives include the development of alternative livelihoods that enhance biodiversity and sustainable development, formalization of miners, multi-actor cooperation to combat illegal trade of mercury and prevent the diversion of mercury from both foreign and domestic sources to use in ASGM, and by promoting the mercury-free gold supply chain (e.g., through certification schemes, recycling of gold).

Target 10 – Agriculture, aquaculture, fisheries and forestry

- Incorporate the impact of mercury on fish stocks, including threatened species, into the considerations for supporting the sustainable management of fisheries.
- In improving the sustainability of agriculture, aquaculture and forestry, implement measures that reduce mercury methylation, bioaccumulation in the food chain, leaching from soil and export through waterbodies, and may present opportunities for activities with co-benefits within the chemicals and waste cluster.

Target 11 – Ecosystem functions and services

- Consider and demonstrate how national and global monitoring of mercury in air and water under the Minamata Convention could contribute to Target 11 indicators.
- Use ecosystem-based approaches, such as natural capital assessment, to factor in atmospheric mercury measurements into national air emissions accounts.

Target 12 – Human health and well-being

- Disseminate approaches to reduce mercury use and emissions in urban areas in concert with implementation of Minamata Convention control articles.
- Include mercury in air and water pollution standards and develop improved methods for comprehensive inventories of mercury emissions and releases in urban areas, which include diffuse sources and currently unknown point sources.
- Share latest information from emissions inventories to support the effectiveness evaluation of the Convention and contribute to the GBF.
- Improve methods to determine mercury concentration in surface waters in urban and densely populated areas.

Target 14 – Mainstreaming and integration

- Promote coherent development and implementation of national plans for biodiversity and mercury action.
- Mainstream mercury and biodiversity positive action across different levels of government (e.g., national and sub-national) and across all sectors.
- Ensure that rigorous environmental impact assessments of activities and processes that can lead to high emissions and releases of mercury are conducted, e.g., before permits are issued, and monitor for and redress contamination of water courses or terrestrial areas with mercury.

Target 15 – Businesses

- Ensure that mercury is factored in regular monitoring, assessment and disclosure of risks, dependencies and impacts on biodiversity in the of large and transnational companies and financial institutions.

Target 16 – Sustainable consumption

- Conduct tailored and wide-reaching awareness campaigns on the impact of mercury on the environment and human health to enable consumers to make sustainable consumption choices.

- Facilitate the development of certification programmes that ensure that gold is sourced responsibly, without or with reduced amounts of mercury, while supporting the development of ASGM communities and respecting the rights of Indigenous peoples and local communities.
- Raise awareness about the risk of mercury in cosmetics and improve capacity of health agencies to monitor and detect products available in the market.

Target 18 – Incentives and subsidies

- Measure the reduction in mercury emissions and releases as a result of phasing out of harmful incentives to fossil fuels.
- Provide adequate resources and incentives to achieve the reduction or elimination of the use of mercury in ASGM (e.g., standards for and marketing of mercury-free ASGM), promote alternative sources of income, improve the supply chain of and access to the alternative products (e.g., agricultural produce, eco-tourism), and facilitate access to financial incentives that support mercury and biodiversity positive action.
- Provide other positive incentives that can generate co-benefits to mercury control and biodiversity.

Target 19 – Financial resources

- Develop and implement projects that seek to improve coherence across biodiversity and chemicals action, focusing on building on existing experiences and priorities from countries (e.g., GEF project on strengthening the enabling framework for biodiversity mainstreaming and mercury reduction in ASGM in Guyana).
- Increase public and private sector financing and co-financing of activities to obtain co-benefits.

Target 20 – Capacity building and technology transfer

- Include capacity building as a cross-cutting feature that can be applied in areas where interlinkages have been identified, such as:

  i. Promoting the adoption of mercury-free alternatives and control methods in the ASGM sector (supporting GBF Targets 2, 3, 7 and 14);

  ii. Developing capacity to monitor mercury levels and impacts on biota and wildlife to inform the reduction of risks (supporting GBF Target 7);

  iii. Developing and promoting sustainable diversified livelihoods, particularly in ASGM regions, in accordance with the NAP guidance pursuant to Art. 7 and the GEF-8 Biodiversity Focal Area Strategy.

Target 21 –Knowledge management

- Integrate knowledge management, public awareness and education efforts to improve understanding among decision makers and stakeholders about the interconnections between biodiversity and mercury pollution, leading to more informed policy making and public engagement.

Target 22 – Indigenous peoples and local communities

- Ensure that Indigenous Peoples and local communities, including women and children among them, have responsive representation and participation in decision-making and access to justice and information related to impacts of mercury on biodiversity, including their traditional sources of food.
- Include, in the NAPs, strategies to prevent the exposure of vulnerable populations, particularly children and women of child-bearing age, especially pregnant women, to mercury used in ASGM.
- Ensure the effective engagement of Indigenous Peoples, local communities and other relevant stakeholders in the development and implementation of NAPs.

Target 23 – Gender

- Ensure that the application of a gender-responsive approach takes into consideration risks related to mercury-contaminated soil and water in efforts to ensure equal rights and access to land and natural resources.
- Enhance training on incorporating gender aspects into project proposal development and project implementation.

In addition to its Targets, the GBF also outlines, under Section J, critical mechanisms for responsibility and transparency, including national biodiversity strategies and action plans (NBSAPs), and national reports and other indicators in the monitoring framework of the GBF. These provide opportunities for considering aligning preparation of national action plans and national reporting between the CBD and the Minamata Convention.

In accordance with decision MC-4/12, the report put forward recommendations for the way forward. The following is an overview of the recommendations with further details provided in Section 6.4:

(a) The Secretariat of the Minamata Convention could be tasked with the development of a roadmap that outlines and prioritizes impact-driven actions that are supportive of the objective of the Minamata Convention and of the Goals and Targets of the GBF. The roadmap could focus on and build upon existing and planned actions to reduce the exposure of, and impact on biodiversity and ecosystem services of the use of mercury in ASGM, mainstream biodiversity and mercury control measures into coherent policy development and implementation, improve research on the impacts of mercury on biodiversity and ecosystem services, monitor impacts on biodiversity and health by utilizing and adapting existing monitoring programmes, restore degraded land and water bodies, and implement sound waste management. To this end, the Secretariat could be tasked take relevant action, which could include the circulation of a notification to Parties and/or the organization of webinars to collect and synthesize information from Parties and other stakeholders on their experience, in particular to and identity good practices, gaps and challenges for joint implementation, to help inform the development of the roadmap for consideration by the Conference of the Parties to the Minamata Convention at its sixth meeting.

(b) Parties and other governments to the CBD, as appropriate, could reflect their goals for national mercury reduction and control measures while revising and updating NBSAPs in accordance with the guidance provided in annex I to decision 15/6.

(c) The ad hoc technical expert group, which was mandated by the CBD COP to revise the indicators for monitoring the GBF, could consider adding one or more indicators related to the amount of highly hazardous chemicals entering the environment (as headline indicator) and to the amount of mercury and entering the environment from anthropogenic sources and mercury levels in people and animals (as optional component indicators).

(d) The Open-Ended Scientific Group could be invited to develop indicators to be used to track the contribution of the Minamata Convention to biodiversity as part of the indicators to support the effectiveness evaluation of the Convention. Moreover, the Effectiveness Evaluation Group could be invited to consider biodiversity aspects during the effectiveness evaluation of the Minamata Convention.

(e) The Global Environment Facility could be invited to maximize co-benefits across focal areas by, for example, integrating mercury action into programmes and projects developed under the Biodiversity Focal Area and integrated programmes of the eighth replenishment of the Global Environment Facility Trust Fund, including scaling up mercury-reducing technologies and sustainable livelihoods as alternatives to ASGM in the Amazon, Congo, and Critical Forest Biomes Integrated Program, as well as through the new Global Biodiversity Framework Fund.

(f) In regard to international cooperation, relevant discussions and decision-making at the international level on enhancing coherence among the biodiversity-related MEAs could include the chemicals and waste MEAs, including the Minamata Convention. Furthermore, the Minamata Secretariat could cooperate with other biodiversity related multilateral environmental agreements and intergovernmental organizations and support the thematic discussions of the Liaison Group of Biodiversity-related Conventions, including those facilitated by the Bern process.

(g) The linkage between biodiversity and mercury could be more strongly featured in the work of relevant science-policy bodies and assessments to better contribute to the understanding and mitigation of mercury's impact on biodiversity. This includes exploring opportunities for conducting thematic projects and studies in cooperation with the Convention on Biological Diversity, the International Whaling Commission, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and the Convention on Migratory Species, among others.

1. Introduction

1.1. Context

At its fourth meeting, held in March 2022, the Conference of the Parties to the Minamata Convention on Mercury, in decision MC-4/12, took note of the study entitled "Interlinkages between the chemicals and waste multilateral environmental agreements and biodiversity"[3] while emphasizing that the implementation of the Convention contributes to the achievement of the Sustainable Development Goals and to addressing the triple planetary crises of pollution, biodiversity loss and climate change.

In the same decision, the COP to the Minamata Convention requested the Secretariat to continue gathering knowledge about, raising awareness of and demonstrating the contribution of the implementation of the Convention to other relevant international regulations and policies, including those related to biodiversity, and to prepare a report on how the Convention could contribute to the post-2020 global biodiversity framework, once adopted, for consideration by the Conference of the Parties at its fifth meeting from 30 October to 3 November 2023.

The Kunming-Montreal Global Biodiversity Framework (hereafter the "GBF") was adopted by the Conference of Parties to the Convention on Biological Diversity ("CBD"), at its fifteenth meeting (COP 15), which was held in December 2022 in Montreal, Canada. The GBF sets out an ambitious pathway to galvanize urgent and transformative action by Governments, and subnational and local authorities, with the involvement of all of society, to reach the global vision of a world living in harmony with nature by 2050 where "*biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people*".

In its decision 15/13, on cooperation with other conventions and international organizations, COP 15 welcomed the contributions of other biodiversity-related conventions, multilateral agreements and international organizations and processes to enhancing synergies in the implementation of the Kunming-Montreal GBF and encouraged the strengthening of cooperation and synergies among relevant conventions and multilateral agreements.

At the national level, the national biodiversity strategies and action plans (NBSAPs) are expected to be a key component of the enhanced planning, monitoring, reporting and review mechanism for the Kunming-Montreal Global Biodiversity Framework. Guidance for revising and updating NBSAPs was provided in annex I to decision 15/6.

Information on the necessary financial resources for implementation of the GBF were adopted in decision 15/7. The decision, among other things, recognized the urgency to increase international biodiversity finance and requested the Global Environment Facility to establish, in 2023, a special trust fund to support the implementation of the Global Biodiversity Framework, to complement existing support and scale up financing to ensure its timely implementation.[4]

In response to the decision, the 64th meeting of the Global Environment Facility Council, held in Brasilia from 26 to 29 June 2023, established the Global Biodiversity Framework Fund. The Council also approved the GBF Fund Programming Directions setting forth the principles by which resources will be included in the GBF Fund. To achieve strategic complementarity, the Programming Directions will focus

[3] Available as document UNEP/MC/COP.4/INF/13.

[4] The Programming Direction of the eighth replenishment of the GEF Trust Fund (2022-2026), which was already in place at the time when the GBF was adopted, provides financial support to countries through Focal Areas on biodiversity, climate change and international waters, as well as through eleven Integrated Programs that follow a programmatic approach to address multiple environmental threats at once.

on eight thematic Action Areas. Specifically on chemicals, the GBF Fund Action Areas will provide complementarity and scaling up support to address and reduce pollution risks to levels that are not harmful to biodiversity and ecosystem functions and services including support to national policy development. This and other GBF Fund Action Areas may provide opportunities to countries to enhance the contribution of the Minamata Convention to the GBF and vice-versa.

1.2. Objective

The study underpinning this report was carried out to five effect to decision MC-4/12, where the COP to the Minamata Convention requested the Secretariat to analyse how the implementation of the Minamata Convention could contribute to the GBF.

The report also responds to paragraph 7(q) on "Cooperation and Synergies" of the GBF calling for "*enhanced collaboration, cooperation and synergies between the CBD and its Protocols, other biodiversity-related conventions, other relevant multilateral agreements and international organizations and processes, in line with their respective mandates, including at the global, regional, subregional and national levels, would contribute to and promote the implementation of the Framework in a more efficient and effective manner*".

The objective of the report is to identify and map opportunities for generating co-benefits to the Minamata Convention and the GBF through coherent and mutually supportive implementation.

The report was made possible through the generous financial contribution of the governments of Norway and Sweden.

1.3. Methodology

The report looked at past and present experience on how Parties to the CBD are integrating mercury-related control measures into their national biodiversity strategy and action plans, and national reports, as well as how Parties to the Minamata Convention have included biodiversity-relevant measures in their national action plans on artisanal and small-scale gold mining, initial assessments under article 20 and national reports under article 21. The report also reviewed, in a non-exhaustive manner, scientific literature on the interlinkages between mercury and biodiversity.

The methodology of the report consists of a review of:

A) **Scientific literature** to highlight a few examples of interlinkages between mercury and biodiversity, focusing on identifying opportunities for biodiversity-positive action in the articles of the Minamata Convention and, conversely, identifying elements in the GBF Targets that are relevant for the control of mercury throughout its lifecycle to reduce its use, emissions and releases.

B) **National submissions** from Parties to the CBD and the Minamata Convention to understand how Parties and other governments put into practice the interlinkages between mercury and biodiversity. The following submissions were reviewed:

- National plans:
  - The **National Biodiversity Strategies and Action Plans (NBSAPs)**[5] under the CBD are key policy instruments for advancing biodiversity conservation and sustainable use at national and sub-national levels. It is also important to note that Parties to the CBD are expected to revise and update their NBSAPs to align them with the GBF Goals and Targets. This will provide an

[5] Available at https://www.cbd.int/nbsap/.

opportunity for introducing mercury-related control measures in the revised and updated NBSAPs;

- National Action Plans (NAPs) for artisanal and small-scale mercury mining (ASGM) under the Minamata Convention;[6]

- National reports:
  - National reports under the CBD (reporting periods 1-6);[7]
  - National reports under the Minamata Convention (first full reporting period).[8]

Figure 1 provides a schematic overview of the review of available information conducted for the report. First, the review of the scientific and grey literature focused on select articles of the Minamata Convention that were considered important for biodiversity due to reference to key words (e.g., biota, environment, or contamination). It is noted that this review was not exhaustive as it is not feasible to cover all interlinkages associated with other articles due to the complexity of the issues and limited timeframe of the preparation of the report. Second, national plans and national reports submitted by Parties under both conventions were covered by the analysis. The national submissions were screened manually using the key word 'mercury' for the NBSAPs and national reports of the CBD and key words 'biodiversity', 'ecosystems', 'nature', 'species' and 'populations' for national reports and NAPs of the Minamata Convention. The review of national submissions complemented the scientific review, emphasizing many same interlinkages, while offering different nuances in potential opportunities for joint action.

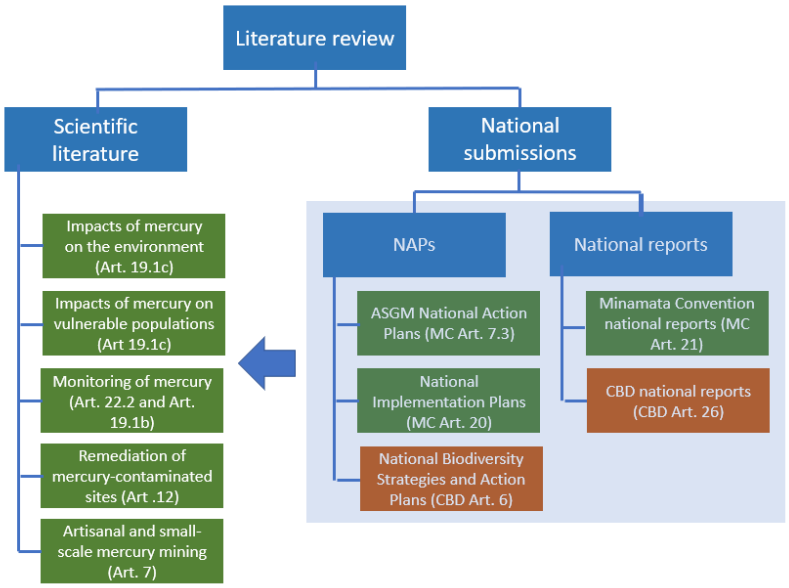

Figure 1. Main sources of the literature review and analysis. Green colour is used to indicate relevant articles of the Minamata Convention and orange colour is used to indicate relevant articles of the CBD.

[6] Available at https://minamataconvention.org/en/parties/national-action-plans.
[7] Available at https://www.cbd.int/reports/.
[8] https://minamataconvention.org/en/parties/reporting.

1.4. Structure of the report

The introduction (section 1) of the report describes the context, objective, methodology and structure of the report. Section 2 provides a brief background to previous reports (grey literature) examining the interlinkages between biodiversity and chemicals, including mercury. Sections 3 and 4 provide the results of the review of the scientific literature and national submissions, respectively. Section 5 summarizes linkages between the Minamata Convention to the GBF, provides examples of possible activities for improving coherence in the implementation of both instruments, and identifies possible indicators for follow-up. Lastly, section 6 provides concluding remarks, highlights key opportunities to generate co-benefits, identifies barriers, and puts forward recommendations for action at the national and international levels.

2. Background

There is increased recognition of the need for coherence in policy development and implementation throughout efforts to address the environmental crises of biodiversity loss and chemical pollution. In this regard, the development of the GBF sought to respond to the *Global Assessment Report of Biodiversity and Ecosystem Services*[9] issued by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the fifth edition of the *Global Biodiversity Outlook*[10] issued by the Secretariat of the Convention on Biological Diversity that identified pollution, including that caused by mercury and other heavy metals, among the main drivers of biodiversity loss. The *Global Biodiversity Outlook* further noted that mercury and many of its compounds were toxic and could have a range of impacts on species, ecosystems and human health.

During the development of the GBF, several other reports have been published to advance understanding about the opportunities for enhancing coherence between the biodiversity and chemicals clusters of multilateral environmental agreements (MEAs). Briefly, these reports include:

In 2021, UNEP organized the second consultation workshop of biodiversity-related conventions on the post-2020 Global Biodiversity Framework (also known as the "Bern II" workshop) (UNEP, 2021). The workshop focused on opportunities for enhancing synergies among the eight conventions that participate in the Liaison Group of Biodiversity-related Conventions and other relevant MEAs in the development of the GBF, including the Secretariat of the Minamata Convention. The final report of the workshop includes conclusions as follows:

- Integrate the **objectives** of relevant MEAs into the GBF (conclusion 1).
- Include relevant indicators used by other conventions in the **GBF indicator and monitoring framework** (conclusions 2-3).
- Facilitate coherent **review of implementation and reporting**, including by increasing clarity on how the objectives, roles and responsibilities of each MEA are integrated into the GBF (conclusions 4-5).
- Identify potential areas for cooperation on **means of implementation**, including **integrated approaches** and **joint work programmes** on specific topics (conclusions 6-7).
- Enhance interaction among **national MEA focal points** in the development/implementation of national biodiversity strategies and action plans (NBSAPs) (conclusions 8-10).

[9] Available at https://doi.org/10.5281/zenodo.3831673.
[10] Available at https://www.cbd.int/gbo/gbo5/publication/gbo-5-en.pdf.

- Reflect the GBF in the **strategies and work plans** of conventions/processes (conclusions 11-12).

In 2021, the BRS Conventions and the Minamata Convention published a technical report that explored interlinkages between the chemicals and waste and biodiversity MEAs (BRS and Minamata Secretariats, 2021). The report highlighted that pollution can be a key driver of biodiversity loss and described how ecosystems and biodiversity are affected by mercury and other chemicals and waste. The report also highlighted the need to better understand the cumulative effects of mercury and other hazardous chemicals. The report raised concern over increasing anthropogenic mercury emissions that are polluting the air, freshwater and oceans, with severe consequences for human health and the environment, particularly biodiversity. The report strengthened the following interlinkages between biodiversity loss and mercury pollution:

- **Artisanal and small-scale gold mining (ASGM**) is the single biggest source of anthropogenic mercury emissions/releases. Contamination of air, soil and freshwater bodies with mercury used in ASGM impacts biodiversity, ecosystems and human health. Moreover, ASGM often takes place in tropical ecosystems of high biodiversity importance and home to numerous species that are threatened with extinction. Some of the tropical ecosystems where ASGM is prevalent appear to be particularly sensitive to elevated methylation rates and also serve as sources of mercury in long-range transport to, for example, the Arctic region.

- The **Arctic environment** is a sink for methylmercury that originates from distant sources. This creates significant concern about vulnerable human populations in the Arctic, particularly Indigenous Peoples (see below), as well as for the Arctic wildlife, which are known to accumulate high levels of methylmercury. A further challenge in relation to mercury in the Arctic region relates to the re-volatilization of mercury that is expected to happen due to melting cryosphere as a result of climate change.

- **Indigenous Peoples** rely on traditional foods for their diet, culture, livelihood and spirituality and are disproportionately at risk from environmental contaminants, including mercury. Indigenous Peoples are also regarded as the "guardians of nature" because they safeguard 80 percent of remaining global terrestrial biodiversity. Indigenous Peoples are particularly vulnerable to mercury through occupational exposure or from living in proximity to point sources of mercury, such as ASGM, or through consumption of traditional foods contaminated with mercury from long-range transport. For example, Indigenous communities in the Amazon forest, which is one of the most important biomes in terms of biodiversity, and the Inuit in the Arctic were found to elevated mercury levels.

- Mercury affects **ecosystem services, which are nature's contributions to people**, including nature's ability to regulate air and water quality, as well as to provide food from fresh and marine waters, among others.

In 2022, the Nordic Council of Ministers published a report on strengthening collaboration and coordination between the chemical and waste and biodiversity clusters (NCM, 2022). The report outlined several options to enhance cooperation at national level, by the governing bodies of MEAs, and by organizations working at regional and/or global level to support implementation. The report provided 18 options for action, organized in four groups summarized below:

- Enhance cooperation in **areas of common interest**, including communications, identification of risks, development of implementation processes (e.g., legislation), research and joint projects.

- Enhance cooperation through **implementation mechanisms,** including national focal point systems, institutional mechanisms, joint activities at the national and international levels.

- Coordinate **common needs and services**, including monitoring and reporting, capacity building, outreach and science-policy interface.
- Identifying **international entry points for collaboration,** including UNEA and other international fora, regional cooperation forms and collaborating in the context of a 'One Health' approach.

In 2022, UNEP published a revised assessment on linkages with other clusters related to chemicals and waste management (UNEP, 2022). The assessment explores interlinkages of the chemicals and waste cluster to seven relevant thematic topics, including biodiversity. The report identifies the following interlinkages between the biodiversity loss and mercury pollution:

- Land degradation and biodiversity loss is linked to informal or poorly regulated **ASGM operations**, often using mercury and occurring in the protected areas, which needs to be tackled with collaborative efforts, including through (a) the development of Minamata NAPs that aim to reduce/eliminate mercury use and provide a framework for sustainable transformation of the sector (collaboration is already taking place in the context of other ASGM-related programmes - GEF funded PlanetGOLD), and (b) joint research and identification of possible solutions to minimize the impact of artisanal and small-scale gold mining operations on biodiversity.
- Contribute **scientific and technical input to the GBF** by sharing experience, methodologies and databanks of pollutant monitoring through the application of the existing methodologies for monitoring and baseline assessments against which the progress may be assessed.
- Strengthen the **GBF Target on pollution** by identifying priority chemicals/pollutants based on key scientific and technical assessments, including mercury, and by identifying available data sources, including the Global Mercury Assessment (GMA).

3. Examples of mercury impacts on biodiversity

This section demonstrates, through examples from the scientific literature, the breadth and significance of mercury's impact on biodiversity and helps the identification of entry points for generating mutual benefits from the implementation and follow-up of the Minamata Convention and the GBF. In this regard, five core provisions of the Minamata Convention were identified as possible entry points for enhancing the contribution to and from the GBF:

(f) Assessment of impacts of mercury on the environment (Art. 19.1c)

(g) Assessment of human health, social, economic and cultural impacts, particularly in respect of vulnerable populations (Art. 16 and Art. 19.1c)

(h) Artisanal and small-scale mercury mining (Art. 7)

(i) Monitoring the presence and movement of mercury in the environment (Art. 22.2 and Art. 19.1b)

(j) Remediation of mercury contaminated sites (Art. 12)

(k) Human health aspects (Art. 16)

3.1. Assessment of impacts of mercury on the environment (Art. 19.1c)

Art. 19.1c of the Minamata Convention states that "*Parties shall endeavour to cooperate to develop and improve, taking into account their respective circumstances and capabilities, assessments of the impact of mercury and mercury compounds on […] the environment*."

The assessment of impacts of mercury can help to create more targeted measures to protect threatened species and support the conservation and sustainable use of biodiversity. However, the impacts of mercury on species, populations and ecosystems are still poorly understood. In this context, it will be important to improve our understanding of the contribution of mercury to the cumulative effects of multiple environmental stressors, including other environmental contaminants, climate change, changing use of sea and land, direct exploitation of organisms and invasive non-native species.

Mercury is a pervasive heavy metal that enters the environment through anthropogenic and natural sources. Growing anthropogenic emissions of mercury have raised serious concerns due to its ability to contaminate land, air, water, and biota in aquatic and terrestrial environments. This poses a significant threat to biodiversity and ecosystems, including through short-term and long-term effects. Mercury can be converted into methylmercury that poses a particular risk as it not only bioaccumulates in animal and human tissues, but also biomagnifies as it moves up the food chain. While many studies that have done on impacts, they rely predominantly on *in vitro* studies, or on a few individuals, and focus largely on specific species. It is important to better understand the impacts of mercury on the environment at various levels in order to take targeted measures to protect vulnerable species, populations and ecosystems. The following summarize some observed effects of mercury on animal health:

- **Cytotoxic effects** observed in aquatic species includes changes in lipid metabolism, cellular transport, changes on gene expression, alterations in the growth and characteristics of plasma and blood, and alterations in antioxidant enzymes that induce oxidative stress and genotoxicity (de Almeida Rodrigues, 2019).
- **Immunotoxic effects** from chronic exposure to mercury can impair immune function, reducing the ability of animals to resist or recover from infections (Becker et al., 2017).
- **Neurotoxic effects** observed in aquatic species includes reduction of swimming, and reduction of the heartbeat, alteration of the shoaling and avoidance behavior of predatory animals (de Almeida Rodrigues, 2019). Similarly, in mammals, nervous system damage results in sensory and motor deficits and behavioural impairment as animals become anorexic and lethargic (Kershaw & Hall, 2019).
- **Reprotoxic effects** (e.g. decreased viability of sperm and motility) can impair reproductive success that may hinder species maintenance in their habitats and increase risk of extinction (de Almeida Rodrigues, 2019; Massányi et al., 2020).

Below are some examples of the impacts of mercury across animal taxa. Far from being an exhaustive list of impacts, these examples aim simply to provide a glimpse at the breadth of mercury effects across different species of vertebrates.

3.1.1. Fish

Fish are vulnerable to mercury contamination and experience negative effects on gonadal development, sex hormone production, reproduction, and behaviour when exposed to methylmercury in laboratory and lakes under controlled conditions. Studies on wild populations also show that methylmercury can affect reproduction of fish (reviewed by Nabuurs et al., 2023).

3.1.2. Amphibians

Amphibians may be particularly at risk to mercury contamination given their current global decline and extinction rates. Their permeable skin, exposure to aquatic environments during certain life stages, and unshelled eggs make amphibians sensitive to environmental contaminants including heavy metals (Markham & Sangermano, 2018). Mercury pollution has been related to decreases in food consumption and body size and increases in mortality of amphibians (Markham & Sangermano, 2018). The following examples illustrates the effects of mercury on amphibians:

- Two-lined salamanders (*Eurycea bislineata*) collected at sites with high mercury levels consume half as much food as salamanders collected at uncontaminated sites and appear to have slower responses capturing prey and speed (Burke et al., 2010).
- American toads (*Bufo americanus*) exposed to mercury through maternal transfer or through their diet as larvae are 7% smaller than control subjects, indicating mercury effects persist after metamorphosis (Todd et al., 2012).
- Bufo americanus larvae exposed to mercury through maternal transfer and diet experience 50% higher mortality than controls (Bergeron et al., 2011).

3.1.3. Reptiles

The long lifespan of turtles makes them vulnerable to pollutants that accumulate in ecosystems over time. Species that feed at high trophic levels are highly vulnerable to pollutants such as mercury (Stanford et al., 2020). Turtles also lie on or bury into underwater substrates, especially during their winter dormancy called 'brumation', where toxins such as heavy metals accumulate (Stanford et al., 2020). Yet, compared to birds and mammals, turtles have received little attention in terms of mercury pollution in contaminant studies (Bergeron et al., 2007).

Hopkins et al. (2013) evaluated the consequences of maternally transferred mercury on the common snapping turtle (*Chelydra serpentina*). Mercury concentrations in eggs were strongly and positively correlated with mercury levels in female tissues. Also, mercury in eggs was negatively correlated with hatching success, and this effect was driven by both increased egg infertility and embryonic mortality. This means that exposure to maternally transferred mercury can have a profound influence on offspring phenotype and act as a significant source of mortality in wildlife populations. It is important to consider activities that could potentially aid in maintaining healthy turtle populations in mercury contaminated areas. For instance, the protection and/or construction of nesting habitats may help mitigate reduced reproductive success in contaminated areas (Hopkins et al., 2013).

3.1.4. Birds

Many birds, including marine and migratory songbirds, are at high risk of methylmercury exposure due to their trophic position and foraging in and around wetland habitats (Adams et al., 2020). Data from studies on terrestrial mercury bioaccumulation in temperate forests have revealed that bird blood mercury concentrations correlate with mercury concentrations in deposition and that songbirds consuming entirely terrestrially-derived food can exhibit elevated mercury concentrations (Gerson et al., 2022). Birds appear to be particularly susceptible to methylmercury, including endocrine and immune system disruption, neurological impairment, effects on flight performance, reproductive impairment, reduced song quality (Adams et al., 2020).

Mercury pollution poses a significant challenge to bird migration by disrupting vital physiological processes (e.g. navigation, flight endurance, and oxidative balance) that have the potential to contribute to global

declines in migratory bird populations (Seewagen, 2020). There is an increasing need to better understand the impact of mercury on bird migration and its role in the global transport of mercury.

3.1.5. Mammals

Cetaceans

The accumulation of mercury in various tissues of cetaceans has been linked to renal and hepatic damage as well as neurotoxic, genotoxic, and immunotoxic effects. The main organ for mercury accumulation in cetaceans is the liver. Other tissues such as brain, kidney, blubber, muscle, blood, skin, teeth and even cetacean earplugs also contain measurable mercury concentration. (Kershaw & Hall, 2019)

Current beluga whale populations in the western Canadian Arctic have been observed to have mercury concentrations 4–17 times higher than preindustrial levels (Krey et al., 2015). The total mercury concentration in beluga whales is higher than the threshold for neurobehavioral, neurochemical, and neuropathological changes and clinical symptoms of Hg intoxication (Krey et al., 2015). In vitro studies show that mercury can cause suppression of lymphocyte proliferation that could lead to a reduction in host disease resistance (Desforges et al., 2016).

In vivo studies of bottlenose dolphins have shown that mercury accumulates in significant quantities in the liver damaging to hepatic processes (Rawson et al., 1993; Rawson et al., 1995). A four-fold increase in active liver disease in the bottlenose dolphins suggested a significant health effect associated with liver mercury concentrations above 61 µg/g wet weight of tissue (Rawson et al., 1993). In vitro studies show that other effects of mercury in dolphins include apoptosis of renal cells in the kidney in Atlantic spotted dolphins and suppression of lymphocyte proliferation and genetic effects in Bottle nose dolphins (Kershaw & Hall, 2019).

Bats

Bats feeding on insects emerging from contaminated aquatic systems face the risk of accumulating mercury through their insect prey (Syaripuddin, 2014). These aquatic ecosystems, including lakes and rivers, have been contaminated by atmospheric deposition and waterborne points sources, which combined with specific environmental conditions promoting mercury methylation and bioavailability, exacerbate the issue. Additionally, man-made reservoirs, such as those resulting from hydroelectric dam construction, can contain methylmercury, a byproduct of increased bacterial activity. Numerous studies have highlighted the concerning mercury concentrations found in bats, such as:

- Bats at the Kenyir Lake in Malaysia exhibited mercury concentrations approaching or exceeding 10 mg/kg, a threshold at which detrimental effects occur in humans, bats and mice (Murata et al., 1999).
- Fur samples from various species of bats sampled in places that were far removed from mercury point sources in Quebec exceeded the 10mg/kg threshold for mercury concentration in hair (Hickey et al. 2001).
- Bats from sites near point source in other areas of North America were reported to have mercury concentrations ranging from 28 to 132 mg/kg (Wada et al. 2010; Nam et al. 2012; Yates et al. 2014).

Bats play an important role in many habitats around the world and are regarded as keystone species, playing crucial roles in maintaining ecosystem health and providing important services to people, such insect control and pollination. The elevated mercury levels underscore the urgent need for further

research and the implementation of targeted mitigation strategies to address the potential impacts of mercury contamination on bat populations and the ecosystems they inhabit.

Polar bears

The median mercury concentrations in ringed seals from Northwest Greenland sampled in 2006 and 2008 have increased 23–27-fold compared to baseline levels in hair from 1300 AD (Krey et al., 2015). The brain total mercury levels in polar bears are below levels that induce neurobehavioral effects as reported in the literature (Krey et al., 2015).

Ringed seals

Recent estimates show that mercury levels in ringed seals have increased 9–17 times since the 14th century (Krey et al., 2015). The total mercury concentrations in ringed seals are within the range that elicit neurobehavioral effects and individual ringed seals exceed the threshold for neurochemical changes (Krey et al., 2015).

3.2. Assessment of human health, social, economic and cultural impacts, particularly in respect of vulnerable populations (Art. 16 and Art. 19.1c)

Art. 16 of the Minamata Convention lays out provisions related to the human health aspects of mercury exposure. It encourages Parties to identify and protect populations at risk, particularly vulnerable populations, develop and implementation of science-based educational and preventive programmes on occupational exposure to mercury, promote appropriate health-care services for prevention, treatment and care for populations affected by mercury exposure and strengthen institutional and health professional capacities for the prevention, diagnosis, treatment and monitoring of health risks.

Furthermore, Art. 19.1c of the Minamata Convention states that *"Parties shall endeavour to cooperate to develop and improve, taking into account their respective circumstances and capabilities, assessments of the impact of mercury and mercury compounds on human health […] in addition to social, economic and cultural impacts, particularly in respect of vulnerable populations".*

Such provisions and assessments can help to better protect the health and well-being of vulnerable populations, including Indigenous Peoples, local communities, women and children, who are often susceptible to mercury exposure through traditional food or by being in the vicinity to man-made mercury sources.

The preamble of the Convention recognizes the health concerns, especially in developing countries, resulting from exposure to mercury of vulnerable populations, especially women, children, and, through them, future generations, and notes the particular vulnerabilities of Indigenous communities because of the biomagnification of mercury and contamination of traditional foods.

Indigenous Peoples in many areas of the world, including Indigenous communities in the Amazonian region and Inuit from the Arctic, are at increased risk of mercury exposure and impact (BRS & Minamata, 2021). For instance, a study conducted on Indigenous Peoples living along Colombian amazon, where ASGM activities are prevalent, showed that 99.5% of 190 hair samples taken from volunteers exceeded safe mercury limits (Alcala-Orozco, 2019). Commonly, exposure occurs as Indigenous communities are reliant upon traditional and local foods such as fish and marine mammals, due to ASGM activities in the tropical region or as a result of long-rang transport to the Arctic region. Such species also has a strong basis for their culture, spirituality, recreation, and economy (BRS & Minamata, 2021). Authorities should take strong initiatives to evaluate the possible associations between the presence of mercury and the

health of Indigenous communities, since they are highly vulnerable to mercury pollution and associated environmental degradation (Alcala-Orozco, 2019).

3.3. Artisanal and small-scale mercury mining (Art. 7)

Art. 7.2 of the Minamata convention requires each Party that has artisanal and small-scale gold mining and processing (ASGM) within its territory to "*take steps to reduce, and where feasible eliminate, the use of mercury and mercury compounds in, and the emissions and releases to the environment of mercury from, such mining and processing*". If a Party determines that that ASGM in its territory is more than insignificant, it shall develop and implement a National Action Plan in accordance with Annex C (Art. 7.3c). There are also other specific provisions for Parties, including to help educate miners and promote research into sustainable, mercury-free mining (Art. 7.4c).

ASGM contributes to approximately 20% of the global gold production and is which is the largest source of anthropogenic mercury emissions and releases into the atmosphere, soils, and water bodies. ASGM in tropical regions continues to rise globally causing a threat to biodiversity worldwide, as it often starts with deforestation and causes mercury releases that bioaccumulate in the environment and pose developmental, hormonal, and neurological threats to wildlife (Markham & Sangermano, 2018).

ASGM precedes with forest removal and soil excavation, which leads to very low residual forest carbon, loss of ecosystem services, removal of fine sediments and defaunation. Part of the liquid elemental mercury that is used in ASGM activities is lost into rivers and soils during the amalgamation process and tailing discharges, while another fraction is lost to the atmosphere during amalgam burning and gold purification.

ASGM is a complex socio-economic challenge that is connected to wider problems like poverty, inequality, land tenure, internal armed conflict, agrarian change, population dynamics, and national and cross-border migration. Formalization and scaling up of mercury-free technologies for use in ASGM can provide major benefits to human health, biodiversity and ecosystem services. However, a reform of the ASGM sector will require more comprehensive measures of prevention, information generation, and in general improved livelihood alternatives, employment opportunities, and development policies that support effective and full participation of Indigenous Peoples and local communities (Galvis, 2019).

Mercury use in ASGM poses a serious threat to vulnerable populations, including Indigenous Peoples, local communities, women and children, and to biodiversity. Numerous Indigenous communities in Asia, Africa and South America rely on ASGM as their sole or main source of income. On the other hand, illegal ASGM is also often practiced in Indigenous lands and territories, without their consent, and in protected areas. The Secretariat of the Minamata Convention is mapping the different needs and priorities of Indigenous Peoples and local communities to inform policy making in relation to ASGM.[11]

Intact forests capture high levels of atmospheric mercury pollution from ASGM (Gerson et al., 2022). By sequestering atmospheric mercury, intact forests near ASGM may reduce the risk of mercury entering nearby aquatic ecosystems and to the global atmospheric mercury pool. If these forests are cleared, legacy mercury could be mobilized from the terrestrial to aquatic ecosystem via forest fires, evasion, and/or runoff. To this end, the fate of the amount of mercury that is stored within terrestrial systems is greatly influenced by conservation policies (Gerson et al., 2022). Buffer zones surrounding protected areas are designed to control mining and other high impact activities, but they may be similarly subject to illegal mining (Espejo et al., 2018).

[11] See document UNEP/MC/COP.5/INF/8.

Assessment of the extent of ASGM activities and its risk to biodiversity and vulnerable Indigenous Peoples and local communities can help to inform conservation efforts. Airborne and satellite monitoring techniques can provide a high-resolution assessment of the extent of ASGM activities, including associated deforestation (Asner & Tupayachi, 2016; Moomen et al. 2022). Moreover, biodiversity assessments can be carried out to determine which areas are most at risk, including use of irreplaceability–vulnerability analysis to inform and prioritize protection (Markham & Sangermano, 2018).

3.4. Monitoring the presence and movement of mercury in the environment (Art. 22.2 and Art. 19.1b)

Art. 22.2 of the Minamata Convention identifies the importance of "*monitoring data on the presence and movement of mercury and mercury compounds in the environment as well as trends in concentrations of mercury and mercury compounds observed in biotic media and vulnerable populations*." In addition, Art. 19.1b of the Convention identifies potential taxa that can be used to establish baselines and develop geographically representative modelling of mercury in the environment including "*biotic media such as fish, marine mammals, sea turtles, and birds*". Monitoring and modelling of mercury in biotic media is directly linked to and supports efforts in maintaining viable populations of threatened species.

Monitoring of mercury in the environment can help to inform the protection of biodiversity at two levels First, it can include identification of taxa and species that are vulnerable to mercury exposure to help take targeted measures to protect such taxa and species. Second, monitoring can help to identify sites (i.e. habitats, ecosystems and regions) where mercury bioaccumulation and biomagnification occur at higher rates than others to guide the development of targeted interventions, including enhanced monitoring.

3.4.1. Fish

Fish are widely used as a monitoring and assessment tool for mercury contamination because of their relative ease of collection and identification. Fish communities also represent multiple trophic levels within aquatic ecosystems and community-wide assessments can provide information on biomagnification of mercury within aquatic food webs (Buck et al., 2019).

3.4.2. Marine mammals

Cetaceans have a limited ability to metabolise and eliminate or excrete mercury, and therefore sequester it in their tissues. As a result, mercury concentrations in cetaceans may be between 10 and 100 times higher than those measured in other predators at the same trophic level that have a similar average life span and dietary intake. To this end, cetaceans are considered as sensitive and reliable tracers of environmental mercury contamination. (Kerhaw & Hall, 2019

3.4.3. Turtles

Turtles are highly suitable for monitoring mercury contamination, due to their unique features, including wide distribution, the variation in the habitat types they occupy, and the range of trophic levels in which they feed, as well as longevity, allowing for long term exposure to contaminants (Bergeron et al., 2007). Yet, compared to other taxa (e.g., fish and mammals), turtles have received little attention in monitoring of mercury pollution (Bergeron et al., 2007).

3.4.4. Birds

Breeding songbirds are considered useful sentinels for mercury across diverse habitats because they can be effectively sampled, have well-defined and small territories, and can integrate pollutant exposure over time and space (Jackson et al., 2014).

3.5. Remediation of mercury-contaminated sites (Art. 12)

Art. 12.1 states that "*each Party shall endeavour to develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds*". Moreover, Art. 12.2 states that "*any actions to reduce the risks posed by such sites shall be performed in an environmentally sound manner*". Remediation of mercury-contaminated sites provides a valuable opportunity for rehabilitation of degraded ecosystems and improving soil biodiversity. In particular, phytoremediation that involves the use of local plant species known to be hyperaccumulators of mercury is highly promising since it is relatively low-tech and low-cost in its deployment, and may complement and reinforce traditional remediation technologies such as mechanical removal and chemical engineering. Further research is needed to identify local species suitable for phytoremediation.

Mercury pollution is putting a significant burden on both terrestrial and freshwater ecosystems across the globe, resulting from, inter alia, primary mercury mining, industrial mining for gold and other non-ferrous metals and smelting sites, chlorine industrial plants and ASGM areas (Xun et al., 2017). In mining sites, the environmental pressure is often exacerbated by deforestation. Due to soil loss and large-scale topographic change caused by gold mining (including industrial and artisanal mining), most mined areas have a reduced probability of returning to their original state and is more likely to remain as degraded areas (Espejo et al., 2018). The remediation of mercury polluted sites is needed for rehabilitation of degraded ecosystems and improving soil biodiversity. However, there are no known examples of large-scale restoration successes on previously mined landscapes (Asner & Tupayachi, 2016). Moreover, even if restoration efforts are undertaken, it will not ameliorate the extreme ecological losses incurred by gold mining in the first place.

Various traditional remediation technologies such as mechanical removal and chemical engineering are available but are often expensive and incompatible to soil structure and fertility (Xun et al., 2017). To this end, phytoremediation, which refers to the use of plants and associated soil microbes to reduce the concentrations or toxic effects of contaminants in the environment, has been investigated as a suitable alternative. Ideal plant species used for phytoremediation are local species known to tolerate high levels of mercury, accumulate high levels of mercury in their harvestable parts, and have a rapid growth rate, a profuse root system as well as the potential to produce a high biomass in the sites (Xun et al., 2017). Suitable local species for phytoremediation can be identified by evaluating mercury accumulating capacities of plant species living in mercury-contaminated sites. For instance, Xun et al. (2017) identified a perennial herbaceous plant (*Cyrtomium macrophyllum*), which is widely distributed over China, to have the high potential to extract mercury from soil.

4. Review of national submissions

This section includes the result from the analysis of national submissions to the Convention on Biological Diversity (CBD) and Minamata Convention, including all national reports and national action plans. The analysis is based on mapping the national submissions, which have been included in Annexes 1-4.

4.1. Convention on Biological Diversity (CBD)

4.1.1. National reports

An analysis of all the national reports submitted to the CBD was conducted with the keyword "mercury".[12] The analysis shows that the number and share of national reports mentioning mercury has grown significantly from 4% (6 countries) in the first reporting cycle to over 20% (21 countries) in the sixth and latest reporting cycle. Reports that merely mentioned that ratification of the Minamata Convention have been omitted, as the focus on the analysis was on substantive rather than procedural aspects of implementation. Table 1 provides a summary of the number and share of countries mentioning mercury in CBD national reports.

Table 1. Summary of the number and share of countries mentioning mercury in CBD national reports.

National report	Mercury mentioned	Reports in total	Share	Countries
Sixth	21	103	20.4%	Brazil, Democratic Republic of Congo, Eritrea, Ghana, Guinea-Bissau, Guyana, Iraq, Kazakhstan, Kenya, Kiribati, Lesotho, Namibia, Papua New Guinea, Republic of Congo, Samoa, Suriname, Switzerland, Tonga, Uganda, Yemen, Zimbabwe
Fifth	18	192	9.4%	Brazil, Bulgaria, Canada, Denmark, Germany, Guyana, Iraq, Israel, Kazakhstan, Malta, Mongolia, Mozambique, Norway, Pakistan, Sierra Leone, Slovenia, UK, Zimbabwe,
Fourth	17	179	9.5%	Azerbaijan, Belize, Canada, China, Czech Republic, Denmark, Fiji, Iraq, Lebanon, Malta, Mongolia, Myanmar, Philippines, Romania, Sudan, Sweden, Zimbabwe
Third	4	153	2.6%	Canada, China, Indonesia, Sweden
Second	1	137	0.7%	Kazakhstan
First	6	151	4.0%	Bulgaria, Fiji, Guyana, Iraq, Peru, Portugal

The reporting format of the CBD varies greatly over time. In the latest national report, activities have been reported against the Aichi Biodiversity Targets,[13] but previously activities have been reported more clearly against the obligations in the text of the CBD.

It is expected that the adoption of the GBF will result in changes to the format for national reports under the CBD. However, it is possible to identify specific themes that provide a space addressing the Minamata Convention. These themes have been listed below with examples of reporting from different countries. Annex 1 provides a compilation of the activities reported in CBD national reports (Table A), as well as a succinct summary based on the same data (Table B).

Impacts of mercury on biodiversity and ecosystems (freshwater, oceans, coastal areas, soil, air, forests and marshes):

- The Mara River is threatened by small- and large-scale gold mining activities that rely on mercury (Kenya);

[12] https://www.cbd.int/doc/nbsap/Google%20Keyword%20Search.pdf.
[13] https://www.cbd.int/aichi-targets/target/13.

- Use of mercury and other hazardous chemicals in mining have resulted in soil erosion and contaminated rivers and steams (Mongolia);
- Artisanal gold mining poses serious environmental and health problems to miners and local communities in the Manica Province (Mozambique);
- Freshwater dolphins are threatened due to excessive sedimentation and mercury and noise pollution caused by large gold mining dredges and shoreline blasting operations (Myanmar);
- Disposal of mining tailings impcats coastal areas, raising concern of heavy metal contamination, including mercury (Papua New Guinea);
- The Department of Madre de Dios is seriously affected by gold mining that has cleared 81.000 hectares of forest edging riverbeds (Peru);
- Tailings from small scale miners using mercury (from processing of gold), pose a direct threat to croplands and water systems, and indirectly threaten forest biodiversity, as well as to pose a threat to marshes where traces of mercury have been detected in sediments, plants and fish (Philippines);
- Mercury enters the sea from power plant emissions, mining and manufacturing industry, which may have contributed mass mortalities of catfishes in 1992/93 along the entire coast leading to a near extinction likely due to a sediment-based heavy metal contamination (Sierra Leone);
- The storage and use of chemicals in mining activities, including mercury, poses a serious threat to the coastal and marine environment (Sudan);
- More than a million people are illegally panning for gold along Zimbabwe's rivers, resulting in clearance of trees and digging in riverbeds, which cause soil erosion, landslides and siltation of water bodies and destroy aquatic biodiversity. Moreover, the use of heavy metals such as mercury in mining has contributed to water contamination and poisoning of wildlife and livestock. (Zimbabwe);

Education

- Introduction of education centers in different mining regions (Suriname);

Enforcement

- The activity of a gold mining company has been suspended due to contaminating watercourses with mercury (Mozambique);

Formalization of workers

- Illegal miners are formalized to help align their activities with existing commitments (Suriname);

Diversification of livelihoods

- The National Strategic Tourism Plan aims to diversify unsustainable practices, such as ASGM using mercury, into eco- and nature tourism (Suriname);

Protected areas to decrease runoff

- Phase out use of mercury by 2027 from the mining sector, which is combined with activities to protect the watershed with the establishment of protected areas though a GEF project (Guyana);
- Establishment of forested buffer zones around lakes can help to prevent mercury from entering them, which derives from forestry operations that cause leaching of mercury from soil (Sweden);

Contamination of the food chain

- Anthropogenic sources of mercury include the burning of fossil fuels, nonferrous metal production and waste incineration, but also large-scale hydro-electric developments can also increase methyl-mercury in the food chain;
- Mercury contamination in fish is a severe challenge mentioned in many national reports, including Belize. The risks include using fish for food contamination, but also presents a threat for fish species themselves, as well as predatory fish;
- The hydroelectric project in Tucuruí has resulted in contamination of the food chain with mercury affecting river-side communities and Indigenous peoples (Brazil);
- Long-range transport of mercury has resulted in restrictions to eat predatory fish in certain areas (Norway);
- Fishing includes risks posed by environmental contaminants, including mercury (Portugal);
- An increase in the annual mercury emissions has been detected due to incineration of industrial wastes (Romania);
- Monitoring data of Vaiusu Bay indicates poor status of the marine environment due to presence of lead, iron, arsenic and mercury making marine species highly poisonous (Samoa);
- The general population is highly exposed to mercury via consumption of seafood (Tonga);

Research

- Research projects have been conducted on trends such as mercury pollution of aquatic ecosystems and impacts of mining on biodiversity under Aichi Biodiversity Target 19 (Suriname);

Monitoring of mercury levels

- Monitoring of seabirds shows that the concentration of mercury almost doubled in thick-billed murres from 1975 to 2012 (Canada);
- Mercury is included in air quality monitoring (Canada, Malta);
- Mercury is included in sewage water quality monitoring (China);
- Monitoring of water quality in aquatic systems shows that high concentrations of mercury (Malta);
- Inventory of soil and water contamination;
- Biomonitoring project has been carried out to study effect of mercury on the health of mothers and unborn children (Suriname);
- Increasing levels of mercury found in the Mediterranean Sea (Israel);
- Lead and mercury levels have increased significantly in the topsoil on the past 20 years (Switzerland);

Standards

- Pollution standards for effluents include 53 substances, including mercury (Uganda);

Biodiversity indicators used

- Indicator for tracking mercury concentrations in biota, including wildlife (Canada);

- Contaminated sites, including mercury (Iraq);
- Mercury content in crude wastewater (Kazakhstan);
- Trends in mercury emissions (Kenya);
- Concentration of mercury in fish (Denmark);
- Mercury level in precipitation (Lebanon);
- Monitoring of the water column in aquatic systems (Malta);
- Emissions of air pollutants from stationary sources, including mercury (Mongolia);
- Mercury emissions and releases (Republic of Congo);
- Pressures on vulnerable ecosystem minimized (Samoa);
- Data on bio-monitoring and data on fish species by mercury levels (Suriname);
- Recommended to include a biodiversity indicator to assess trends in mercury emissions (Yemen);

Remediation activities

- Remediation of mercury in the bottom sediment of the Nura River (Kazakhstan);
- Remediation of mercury contaminated land undertaken, including burial and neutralization (Mongolia).

4.1.2. National Biodiversity Strategies and Action Plans (NBSAPs)

An analysis of all the National Biodiversity Strategies and Actions Plans (NBSAPs) submitted to the CBD was also conducted with the keyword "mercury."[14] The analysis shows that the number of countries mentioning mercury has grown from 11 in the pre-Nagoya NBSAP to 18 in the post-Nagoya NBSAPs, meaning that just over 10% of all countries mentioned mercury in their latest submissions. NBSAPs that merely mentioned that ratification of the Minamata Convention has been omitted, as the focus on the analysis was on substantive rather than procedural aspects of implementation. Table 2 provides a summary of the number and share of countries mentioning mercury in NBSAPs. Annex 2 provides a compilation of references to mercury in NBSAPs. The NBSAPs predominantly mention mercury in the description of threats to biodiversity, and outlines little, if any activities, to address mercury. The NBSAPs provide a valuable opportunity to address mercury to support the implementation of various Targets of the GBF.

Table 2. Summary of number and share of countries mentioning mercury in NBSAPs.

NBSAP	Mercury mentioned	Reports in total	Share	Countries
After the adoption of the Nagoya Protocol[15]	18	178	10.1%	Brazil, Finland, Guyana, Belize, Macedonia, Mozambique, Suriname, Norway, Niue, Republic of South Sudan, Myanmar, Rwanda, Liberia, Colombia, Myanmar, Russia, Ukraine, Italy,
Before the adoption of the Nagoya Protocol	11	?	?	Finland, Norway, Sweden, UK, Azerbaijan, Kyrgyz Republic, Kazakhstan, Pakistan, Guyana, Denmark, Estonia

[14] https://www.cbd.int/doc/nbsap/Google%20Keyword%20Search.pdf
[15] See https://www.cbd.int/abs/.

4.2. Minamata Convention

4.2.1. National reports

According to Art. 21 on Reporting each Party must report to the COP, through the Secretariat, on the measures it has taken to implement the provisions of this Convention and on the effectiveness of such measures and the possible challenges in meeting the objectives of the Convention (para 1). National reports requests information of the implementation of the convention, in line with the convention text. The interval for national reports is four years using the full format, which covers 43 questions. Moreover, for the short report, which covers 4 recurrent questions from the full reports must be submitted 2 years before the full report. Table 3 lists reporting obligations outlined in the reporting format of the Minamata Convention.

Table 3. Reporting obligations outlined in the reporting format of the Minamata Convention.

Theme	Information requests in the reporting format
Mercury supply sources and trade (Art. 3)	• Operation of primary mercury mines • Identification of individual stocks and sources of mercury • Availability of excess mercury from decommissioning chlor-alkali facilities • Trade of mercury (among Parties and non-Parties)
Mercury-added products (Art. 4)	• Prohibition and restriction of manufacture, import/export of mercury-added products
Manufacturing processes in which mercury or mercury compounds are used (Art. 5)	• Specific measures applied to various types of manufacturing processes that use mercury or mercury compounds
Artisanal and small-scale gold mining (ASGM) (Art. 7)	• Reduction or elimination of the use of mercury in, and the emissions and releases to the environment of mercury from ASGM • Development and implementation of an ASGM national action plan
Emissions (Art. 8)	• Identification of emissions • Use of best available techniques and best environmental practices (BAT/BEP) to control and reduce emissions for new sources • Measures to reduce emissions • Inventory of emissions • Development of a national plan to control emissions
Releases (Art. 9)	• Identification of releases • Measures to address releases • Development of a national plan to control releases • Inventory of releases
Environmentally sound interim storage of mercury (Art. 10)	• Measures to ensure environmentally sound interim storage of non-waste mercury
Mercury wastes (Art. 11)	• Measures to ensure environmentally sound management of mercury waste • Ensure mercury waste is recovered, recycled, reclaimed or directly re-used for allowed uses • Restriction on the transboundary movement of mercury waste • Facilities for final disposal of mercury waste
Contaminated sites (Art. 12)	• Development of strategies for identifying and assessing sites contaminated by mercury
Financial resources and mechanism Art. 13)	• Provisioning of financial resources to implement the convention. • Provisioning of financial resources to support developing countries
Capacity-building, technical assistance and technology transfer (Art. 14)	• Provisioning of capacity building and technical assistance • Facilitation of sharing environmentally sound alternative technologies
Health aspects (Art. 16)	• Promotion of the development and implementation of strategies and programmes to identify and protect populations at risk.

Theme	Information requests in the reporting format
	• Promotion of the development of and implementation of science-based educational and preventive programmes on occupational exposure • Other measures to protect human health
Information exchange (Art. 17)	• Facilitation of the exchange of information on key topics or areas among parties
Public information, awareness and education (Art. 18)	Promote and facilitate information to the public on: • Health and environmental effects • Alternatives to mercury • Results of research, development and monitoring activities • Activities to meet obligations under the convention
Research, development and monitoring (Article 19)	Cooperation to develop and improve: • Inventories of emissions and releases • Modelling and monitoring of levels of mercury in vulnerable populations and in environmental media, including biotic media such as fish, marine mammals, sea turtles and birds, as well as collaboration in the collection and exchange samples • Assessments of the impact of mercury and on human health and the environment • Harmonized methodologies for the above activities • Information on the environmental cycle, transport (including long-range transport and deposition), transformation and fate of mercury in a range of ecosystems. • Information on commerce and trade in mercury • Information and research on the technical and economic availability of mercury-free products and processes and on BAT/BEP to reduce and monitor emissions/releases

The reporting rate is 93% for the first full national reports to the Minamata Convention that were due 31 December 2021. Annex 3 provides a summary of sections of national reports that address biodiversity-relevant activities.[16] The reporting template is loyal to the convention text and does not specifically ask how biodiversity aspects are addressed and, subsequently the term biodiversity is rarely used in the national reports, but different components of biodiversity and addressed, in particular species in context of monitoring activities under Art. 19. While most of the activities under the Minamata Convention benefit biodiversity indirectly, the analysis of first full national reports to Convention shows that components of biodiversity are most prominently featured in the implementation of the following articles:

- Art. 7: Artisanal and small-scale gold mining
- Art. 12: Contaminated sites
- Art. 14: Capacity-building, technical assistance and technology transfer
- Art. 17: Information exchange
- Art. 18: Public information, awareness and education)
- Art. 19: Research, development and monitoring

The analysis has identified some best practices or promising approaches that could be scaled up to address biodiversity more prominently in the implementation of the Minamata Convention to generate co-benefits across the agendas. Such promising approaches include:

- **Implementation of Art. 7 on ASGM could benefit from the incorporation of the ecosystem approach.** Promoting extractive industries, such as mining and ASGM, in context of the ecosystems approach, is necessary in both planning of mining activities to avoid deforestation, soil

[16] Keywords biodiversity, biological diversity, species, ecosystems and wildlife were used to identify sections of relevance to biodiversity.

degradation and accumulation of tailings and to recovery of mining areas. Adopting an ecosystems approach to ASGM activities will help to jointly promote the realization of CBD and Minamata Convention. This can be achieved with development of necessary guidelines and other necessary tools, with the engagement of both conventions. The GEF also provides a valuable opportunity to address ASGM across focal areas, as well as in relevant impact programmes, in particular Sustainable Forest Management. A goal has been established to phase out mercury use by 2027, which is combined with activities for protection of the watershed by establishing protected areas. The GEF project in Guyana provides a "Strengthening the Enabling Framework for Biodiversity Mainstreaming and Mercury Reduction in Small and Medium-scale Gold Mining Operations" provides an important model in this regards

- **Art. 12 on remediation could include phytoremediation activities to help remove mercury from the soil or watercourses using vegetation.** Phytoremediation means the treatment of pollutants or waste (as in contaminated soil or groundwater) by the use of plants that remove, degrade, or stabilize the undesirable substances (such as toxic metals).[17] Studies have been conducted in Peru assessing possibilities for using the Water Hyacinth for removing mercury and cadmium. However, it is important to ensure that phytoremediation activities do not lead to the introduction of invasive alien species that may threaten endemic species.

- **Capacity building, in accordance with Art. 14, provides an opportunity to promote joint action across the CBD and Minamata Convention**. Biota monitoring provides a valuable entry point for such collaboration.

- **The promotion of public information, awareness and education, in accordance with Art. 18, provides an opportunity to highlight biodiversity impacts, and possibilities for mitigating them.** This can include, inter alia, the organization of online webinars on the effects of mercury on aquatic ecosystems and marine mammals.

- **Biota monitoring is an integral part of complying with Art. 19 of the Minamata Convention that has a clear linkage to biodiversity.** Countries and regions have developed varying monitoring programmes, commonly focusing on detecting the concentration of the mercury in fish species and other aquatic invertebrate. This is typically the case when the safety of fish for human consumption is determined. Many other species also are used in biota monitoring, including dragon flies (US), sea turtles (Uganda), birds, (Uganda), gulls (France), moss (Sweden, Germany), earth worms (Norway), foxes (Norway), seaweed (Ireland), apex predatory mammals (Croatia), ichthyofauna (Ecuador), bears (Canada), ringed seals (Canada), beluga (Canada), caribou (Canada) and seabird eggs (Canada). However, while extensive monitoring data is collected it may not always be comparable, as the methodologies and species used vary across countries and regions. Moreover, the impacts of mercury on the species and the environment are still poorly understood.

4.2.2. National action plans on ASGM

During 2019-2022, 25 National Action Plans have been developed, in accordance with Art. 15 of the Minamata Convention. Biodiversity is explicitly mentioned in 17 NAPs (68% of all NAPs). Annex 3 provides a summary of the link of NAPs to biodiversity, including a description of impacts of ASGM on biodiversity and national activities taken to mitigate those impacts (Table D) and a compilation/classification of the main impacts of ASGM activities on biodiversity, as described in NAPs (Table F).

[17] https://www.merriam-webster.com/dictionary/phytoremediation.

The findings of the analysis shows that biodiversity is most commonly mentioned in context of a description of environmental impacts, but at a very general level, often without specifying species or areas/ecosystems affected. Only 50% of NAPs have included specific interventions goals, targets and activities for mitigating biodiversity loss resulting from ASGM. The NAP of Guyana is the only one that makes explicit reference to the NBSAP developed under the CBD.

ASGM is often described as a driver of deforestation, land degradation and other forms of habitat loss that contribute to biodiversity loss. Many countries highlight the ASGM is taking place in protected areas, which affects biodiversity. Table 4 provides a summary of the main impacts of ASGM on biodiversity before, during and after mining operations, as well as good practices that may inform action to recognize and biodiversity in ASGM activities. The main conclusion is that there is a need to ensure that the impacts of ASGM on biodiversity and nature conservation are identified in NAPs, and relevant targets and activities are outlined to mitigate them. This can help to make national ASGM policies are fully supportive and aligned with GBF Targets.

Table 4. Main impacts of ASGM on biodiversity and good practices identified in NAPs.

Phase	Problem description	Good practices
Planning phase (pre-mining)	The preparation of ASGM mining sites requires removal of plants and trees, which contributes to deforestation and soil degradation that negatively affects biodiversity, especially if the mining sites are located in protected areas. Due to removal of fertile soils, trees are less likely to grow after mining ends.	• Use satellite images to estimate and track the extent of deforestation and land degradation resulting from ASGM activity (Sierra Leone)
Mining phase	**The tailings** in ASGM are released directly into the environment and are a major source of **mercury pollution** that negatively affects both aquatic and terrestrial biodiversity. There is insufficient monitoring data on concentrations of mercury in the environment and biota. Data on impacts of mercury on biota is absent.	• Test and adopt technologies and procedures for storage of mercury and disposal of waste containing mercury (Zimbabwe) • Monitor contamination levels in rivers and other environmental sinks close to mercury processing sites (Zambia) • Strengthen the enforcement capacity of authorities to enforce existing mining legislation, including revoke mining permits if mining wastes are discharged to the environment
	Sediments released to the water increase **turbidity,** thus reducing the amount of light available to the river habitats that adversely affects aquatic biodiversity. The mercury concentrations in freshwater sediments are often elevated in ASGM sites compared non-mining sites.	• Prohibit any mercury or cyanide-based gold processing techniques within 100 m of a natural water body (Zambia)
	Wildlife is impacted by the creation of dirt roads, pits, canals and temporary settlement zones. Wildlife is also unsustainably harvested by miners.	

	Drying up of watercourses by **dredging** and shrinking of swamps through **siltation** affects biodiversity.	
Post-mining phase	**Lack of mine closure and rehabilitation** of abandoned mining contributes to deforestation, biodiversity loss, decreased land suitable for agriculture, and soil erosion. Abandoned pits become traps for domestic and wild animals.	• Assess the extent of environmental contamination from ASGM activities (Tanzania) • Design guidelines for land rehabilitation, mine closure and tailings management (Sierra Leone) • Design a strategy for rehabilitating identified mercury-contaminated sites (Sierra Leone) • Develop and implement a reforestation programme in abandoned mining areas, including provide training in agroforestry (Madagascar) • Make landfilling of abandoned sites mandatory

5. Identified areas for joint action between the Minamata Convention and the GBF

This section maps and summarizes opportunities for generating co-benefits to the Minamata Convention and the GBF through coherent and mutually supportive implementation based on the review of national submissions to the CBD and Minamata Convention and available literature.

Table 5 summarizes and illustrates the linkages between the GBF targets, mercury pollution and the provisions of the Minamata Convention and puts forward examples of future interventions and possible indicators to demonstrate co-benefits and advance the mercury and biodiversity agendas. Table 5 serves as a reference for the development of targeted interventions by Parties and other governments wishing to improve coherence across the Minamata Convention and the GBF.

Table 5. Mapping GBF Targets and the relevance of and to the implementation of the Minamata Convention.[18]

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
Target 1. Ensure that all areas are under participatory, **integrated and biodiversity inclusive spatial planning** and/or **effective management processes addressing land- and sea-use change**, to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030, while respecting the **rights of indigenous peoples and local communities**.	• Mercury emissions and releases to air, land and water can have direct impact on vulnerable ecosystems, including areas of high biodiversity importance, as well as ecosystems of high ecological integrity. • Integrated biodiversity inclusive spatial planning can be an entry point for mainstreaming efforts to protect human health and the environment from the adverse effects of mercury into broader environmental conservation policies. • Working together with Indigenous Peoples and local communities to effectively manage areas of high biodiversity importance will generate co-benefits across the	• Identify areas of high-biodiversity value that also act as sources of methylmercury production and export as priorities for integrated and biodiversity inclusive spatial planning. • Focus efforts on controlling emissions and releases from sources of mercury that pose risks to areas of high biodiversity importance. One approach could involve creating "buffer areas" that are more closely monitored. • Cooperate with Indigenous peoples and local communities to effectively prevent, control and avoid adverse effects of mercury in areas of high biodiversity importance. • Integrate mercury control measures into revised and updated national biodiversity strategies and action plans (NBSAPs) in	• Art. 7.2 requires Parties with ASGM to take steps to reduce, and where feasible eliminate, the use of mercury and mercury compounds in, and the emissions and releases to the environment. of mercury from, such mining and processing. • Annex C identifies measures that can help reduce or eliminate mercury use in ASGM, such as the regulation and formalization of the sector. • Art. 8 and 9 request Parties to control and, where feasible, reduce emissions and releases of mercury and mercury compounds, respectively.	• Areas that favour conversion to methylmercury are identified. • Zoning regulations and land use planning take into account potential effects of mercury emissions on biodiversity. • Implemented measures to control emissions and releases of mercury in areas of high biodiversity importance. • Established partnerships with Indigenous peoples and local communities. • Number of revised NBSAPs that integrate mercury control measures. • Number of NAPs that include and implement biodiversity positive action.

[18] The Table provides a non-exhaustive overview of the relevance of the GBF targets to the Minamata Convention. Other relevant interlinkages may exist, which are not shown in the table, including for targets 6, 8, 12, 13, and 17.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
	Minamata Convention and the GBF.	accordance with CBD decision 15/6 and aligned with the GBF Goals and Targets. • Integrate biodiversity positive action into the development and implementation of national action plans (NAPs) on ASGM in accordance with Art. 7 and Annex C.		
Target 2. Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under **effective restoration,** in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity.	• Mercury pollution affects a number of ecosystem functions and services and ecological integrity. • New technological developments in the field of remediation of mercury-contaminated sites and measures to reduce use, emissions and releases can contribute to the restoration of degraded ecosystems, while reducing emissions and releases will minimize the need for future restoration. • Similarly, the restoration of degraded ecosystems will help reduce the amount of mercury that	• Implement mercury control measures, including but not limited to those under Art. 12, and demonstrate the benefits of restoration of mercury-contaminated sites for biodiversity and ecosystem functions and services, as well as how achievements under GBF Target 2 can contribute to the objective of the Minamata Convention. • Identify suitable and cost-effective methods for scaling up restoration of contaminated sites (e.g., through phytoremediation that uses natural processes and the abilities of plants to absorb and remove contaminants).	• Art. 12.1 requires Parties to endeavour to develop appropriate strategies for identifying and assessing sites contaminated by mercury. • Art. 12.2 adds that any actions to reduce the risks posed by such sites shall be performed in an environmentally sound manner.	• Activities and measures to restore mercury contaminated sites., including examples of co-benefits to mercury and biodiversity positive action from the implementation of Art 12.2 of the Minamata Convention and of GBF Target 2. • Studies demonstrating the feasibility of new technologies for remediation of mercury-contaminated sites, for example, through the use of native plants for phytoremediation. • Training and incentives provided to ASGM miners

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
	(re)circulates through air, land, water and animals. • Wetlands, for example, provide numerous ecosystem services and, under certain conditions, are also important sources of methylmercury production and export which can have implications for ecosystem health.	• Reduce stress on reproductive success caused by mercury exposure in relevant species (e.g., creating mercury-free nesting areas for threatened turtles). • Ensure that priority mercury-contaminated ecosystems, such those that act as sources of MeHg and are of high biodiversity importance (e.g., wetlands), are identified and restored. • Train and create incentives for ASGM miners to rehabilitate abandoned mining sites.		for rehabilitation of abandoned mining areas. • Increased area of land restored or rehabilitated in areas degraded by ASGM.
Target 3. Ensure and enable that by 2030 at least 30% of terrestrial and inland water areas, and of marine and coastal areas, especially **areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed** through ecologically representative, well-connected and equitably governed systems of protected areas and other	• Healthy ecosystems, such as forests and peatlands, capture high amounts of particulate and gaseous mercury from the atmosphere. The effective conservation and management of ecosystems contribute to sequestering mercury, thus reducing reemissions and atmospheric mercury cycling. • ASGM activities often take place in areas of particular	• Assess the extent of ASGM activities in which mercury is used and combine phasing out the use of mercury in ASGM with activities that enhance the conservation and sustainable use of areas of particular importance for biodiversity and ecosystem functions and services. • Mainstream mercury control measures into conservation policies to improve the	• Art. 7.2 requires Parties with artisanal and small-scale mining and processing using mercury to take steps to reduce, and where feasible eliminate, the use of mercury and mercury compounds in, and the emissions and releases to the environment. of mercury from, such mining and processing.	• Extent of protected areas in the ASGM belt that are effectively managed through coherent implementation of the Minamata Convention and the GBF. • Legislation enacted to protect Indigenous and traditional territories that are at risk from external ASGM activities. • Areas of Indigenous and traditional territories that

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
effective area-based conservation measures, **recognizing indigenous and traditional territories**, where applicable, and integrated into wider landscapes, seascapes and the ocean, while ensuring that any sustainable use, where appropriate in such areas, is fully consistent with conservation outcomes, **recognizing and respecting the rights of indigenous peoples and local communities, including over their traditional territories**.	importance for biodiversity and ecosystem functions and services, and pose a threat to endangered species due to deforestation, land degradation, mining tailings and other negative impacts resulting from ASGM. At the same time, ASGM is the only/main source of income for millions of people, including Indigenous peoples and local communities. • Coherent implementation of the Minamata Convention and the GBF in support of sustainable development goals, particularly in areas of importance for biodiversity and ecosystem functions and services, while recognizing and respecting the rights of Indigenous Peoples and local communities, can help minimize harm to both people and nature.	sound management of the ASGM sector. • Use airborne and satellite monitoring techniques to assess the extent of ASGM activities, including associated deforestation. • Conduct biodiversity risk assessments to determine which areas and species are most at risk from mercury pollution. • Uphold the rights of vulnerable populations, including Indigenous peoples and local communities, to an environment free of pollution and enforce legislation to prevent and combat ASGM activities taking place on Indigenous territories without the consent of the affected Indigenous communities.		are regularly monitored for the presence of mercury above thresholds that are deemed safe.
Target 4. Ensure urgent management actions to **halt**	• Mercury pollution impacts wildlife across various	• Increase monitoring of species impacted by	• Art. 19 contains several provisions relevant to this	• Number of management actions taken to mitigate

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
human induced extinction of known threatened species and for the recovery and conservation of species, in particular threatened species, to significantly reduce extinction risk, as well as to maintain and restore the genetic diversity within and between populations of native, wild and domesticated species to maintain their adaptive potential, including through in situ and ex situ conservation and sustainable management practices, and effectively manage human-wildlife interactions to minimize human-wildlife conflict for coexistence	taxa, including amphibia, reptiles, fish, birds, and mammals. Although the extent to which mercury contributes to the extinction of species is unknown, it is clear that its physiological, behavioural and reproductive effects impact some populations and may put additional pressure on species that are already under threat from other stressors, such as polar bears, some whales and other top predators. • Control measures throughout the lifecycle of mercury can help reduce the pressure on threatened species that are impacted by exposure to high levels of mercury. For example, mercury reduces the hatching success of turtles, but its impacts can be alleviated with creation of nesting grounds for them.	mercury to inform the development of possible management action to mitigate the effects. • Support coherent national- and sub-national level implementation of the Minamata Convention and other relevant MEAs, as appropriate, such as the: v. Convention on Biological Diversity on relevant programmatic areas and in the monitoring of the GBF Targets; vi. International Convention for the Regulation of Whaling on the monitoring mercury levels in cetacean species; vii. Convention on Migratory Species on the impact of mercury on migratory species and on how animal migration contributes to the global transport of mercury; viii. The Ramsar Convention on Wetlands to map wetlands of international importance that are at increased risk of mercury pollution.	Target including (19b) for modelling and geographically representative monitoring of levels of mercury in vulnerable populations and biotic media such as fish, marine mammals, sea turtles and birds. • Relevant provisions are also outlined in Art. 14 on Capacity-building, technical assistance and technology transfer, Art. 17 on information exchange, and Art. 18 on public awareness, information and exchange.	the negative impact or mercury on wildlife and, in particular, threatened species. • Number of initiatives at national and sub-national levels that support and demonstrate coherent implementation of relevant MEAs.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
Target 5. Ensure that the **use, harvesting and trade of wild species is sustainable, safe and legal,** preventing overexploitation, minimizing impacts on non-target species and ecosystems, and reducing the risk of pathogen spillover, applying the ecosystem approach, while respecting and protecting customary sustainable use by indigenous peoples and local communities.	• Mercury threatens the ability of people, including many Indigenous peoples and local communities, to safely harvest wild species, including fish and other aquatic animals, due to increased risk of mercury exposure through traditional food. The proximity of Indigenous peoples and local communities to contaminated sites, mercury-containing waste and ASGM activities further increases their vulnerability to mercury in the food chain.	• Support efforts to evaluate mercury exposure pathways and impacts on vulnerable populations, including of Indigenous peoples and local communities, that rely on the sustainable use, harvesting and trade of wild species to support decision-making to better protect their health and livelihoods. • Raise awareness of the risk of mercury toxicity from the consumption of certain wild species among vulnerable populations. • Integrate mercury control measures into approaches that aim at achieving optimal health outcomes recognizing the interconnection between people, animals, and their shared environment (e.g., One Health approaches). • Conduct socio-economic studies to assess the impact of mercury pollution, for example, for communities that rely on artisanal fisheries for their livelihoods.	• The Minamata Convention aims to protect human health and the environment from mercury of anthropogenic origin. • Art. 16 addresses various aspects of human health, including by encouraging Parties to promote the development and implementation of strategies and programmes to identify and protect populations at risk, particularly vulnerable populations, educational and preventive programmes on occupational exposure. • Art. 19.1c states that Parties shall endeavour to cooperate to develop and improve assessments of social, economic and cultural impacts of mercury and mercury compounds, particularly in respect of vulnerable populations.	• Level of awareness among Indigenous communities of impacts of mercury. • Policies and regulations on the interconnections between people, animals, and their shared environment that include mercury control measures. • Studies on the socio-economic impacts of mercury.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
Target 6. Eliminate, minimize, reduce and or mitigate the **impacts of invasive alien species on biodiversity and ecosystem services** by identifying and managing pathways of the introduction of alien species, preventing the introduction and establishment of priority invasive alien species, reducing the rates of introduction and establishment of other known or potential invasive alien species by at least 50 per cent by 2030, and **eradicating or controlling invasive alien species, especially in priority sites, such as islands**.	• Some invasive fish and other aquatic species are known to accumulate more mercury than native species. This can significantly increase the risk of exposure to mercury by people who eat large amounts of fish and other aquatic species, such as many people living on islands. • Efforts to control or eradicate invasive alien species often include the consumption of those species by humans or farmed animals. This type of action is not advisable for invasive alien species that accumulate high levels of mercury. • Invasive aquatic species, such as mussels, can force native species to change their feeding habits, alter food web composition, and influence the health and survival of native species. This can potentially put more pressure on species, in particular those at high	• Monitor the level of mercury in fish and other invasive species that may lead to increased mercury exposure in humans, especially before any eradication and control efforts that promote consumption of invasive species by humans or farmed animals are put in place. • Promote and support research on the impacts of invasive alien species on methylmercury production and food webs.	• Art. 19.1b calls for modelling and geographically representative monitoring of levels of mercury and mercury compounds in vulnerable populations and in environmental media, including biotic media such as fish, marine mammals, sea turtles and birds, as well as collaboration in the collection and exchange of relevant and appropriate samples,	• Studies on the impacts of invasive alien species on mercury methylation and accumulation in food webs. • Monitoring programs that include segregated data on the levels of mercury in invasive species.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
	trophic levels, that are already threatened by other drivers of biodiversity loss. • Invasive species may alter hydrology, biogeochemistry, and microbial processes that control site-specific methymercury production, facilitating subsequent bioaccumulation.			
Target 7. Reduce pollution risks and the negative impact of pollution from all sources by 2030, to levels that are not harmful to biodiversity and ecosystem functions and services, considering cumulative effects, including (a) by reducing excess nutrients lost to the environment by at least half, including through more efficient nutrient cycling and use; (b) by **reducing the overall risk from pesticides and highly hazardous chemicals by at least half**, including through integrated pest management, based on	• Mercury has serious and wide-ranging negative impacts on biodiversity and ecosystem services. These include physiological and behavioural changes that can lead to reduced survival and reproductive success. Mercury also impacts a number of ecosystem functions and services such as the provision of food, clean water and air, enjoyment of nature, etc. • Most countries have banned the production and use of mercury-containing pesticides. This provides an example of	• Support full implementation of control provisions of the Minamata Convention and undertake actions described throughout this document, all of which are relevant to the achievement of Target 7. • Align monitoring efforts under the Minamata Convention and GBF by including, in the Monitoring Framework of the GBF, a component indicator related to mercury under a headline indicator related to highly hazardous chemicals. • Report on the implementation of strategies to reduce and eliminate the emissions and	• Articles 3 through 12 of the Convention contain relevant provisions to reduce the risk of mercury from anthropogenic sources throughout its lifecycle. • Art. 21 on national reporting and Art. 22 on the Effectiveness Evaluation of the Convention.	• Levels of mercury in the environment and other findings on the impacts of mercury, incl. those from the Open-ended Scientific Group. • Other information gathered through the effectiveness evaluation of the Convention. • Publications on the risks and impacts of mercury on ecosystem functions and services, as well as on the impact of ecosystem degradation on mercury cycling.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
science, taking into account food security and livelihoods; and(c) by preventing, reducing, and working towards eliminating plastic pollution.	how mercury control measures can generate global co-benefits for people and nature. • Mercury enters the environment from various anthropogenic sources and processes such as coal burning, industrial and artisanal and small-scale mining, among others. Minamata Convention addresses the full lifecycle of mercury and, thus, reduces the overall risk to ecosystems. • Regulations and concerted action to reduce mercury emissions and releases can decrease the risk of human and wildlife exposure and safeguard the environment and human health from the impacts of mercury from anthropogenic sources. • Reporting on measures to implement the Minamata Convention under Art. 21 and information gathered through the effectiveness evaluation of the Convention can provide	releases of mercury into the environment, with a focus on the main polluting sources and processes (e.g., by reducing mercury use in ASGM and mercury-added products) and improving recovery and environmentally sound disposal of by-product mercury (e.g., from large-scale mining, coal burning, and other industrial processes). • Promote research on the risks and impacts of mercury on ecosystem functions and services and the impacts of degraded ecosystems on mercury cycling. • Promote and support research in wildlife toxicology and mercury monitoring to better predict and assess the risks of mercury pollution to biodiversity and inform the development of policy to reduce emissions and releases. • Contribute and support the effectiveness evaluation of		

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
	crucial insights to monitor progress towards Target 7. However, the absence of suitable indicators in the GBF Monitoring Framework to measure progress in reducing the risks of mercury may limit the ability to demonstrate the effectiveness of the efforts.	the Minamata Convention, including through the development of temporal trends of mercury in the environment and the development of risk modelling. • Conduct risk assessments of the cumulative effects of mercury and other highly hazardous chemicals.		
Target 8. Minimize the **impact of climate change and ocean acidification on biodiversity** and increase its resilience through mitigation, adaptation, and disaster risk reduction actions, including through nature-based solutions and/or ecosystem-based approaches, while minimizing negative and fostering positive impacts of climate action on biodiversity.	• Reduction of mercury use in specific industrial applications including chlor-alkali and vinyl chloride monomer production will also reduce greenhouse gas emissions from those sectors. • Control of mercury emissions from Annex D sources (coal-fired power plants, coal-fired industrial boilers, cement production, non-ferrous metals production, and waste incineration) can be undertaken in ways that maximize climate co-benefits. • Interlinkages between climate change and ocean	• Support full implementation of control provisions of the Minamata Convention with respect to mercury use in industrial processes and mercury emissions control, with direct relevance and co-benefits to climate change. • Promote research and cooperation to improve understanding of, and to identify possible actions to mitigate the impacts of climate change and ocean acidification on mercury cycling, long-range transport and environmental fate, and the associated contribution to biodiversity loss.	• Article 5 and Annex B on mercury use in industrial processes • Article 8 and Annex D on mercury emissions • Art. 19.1b calls for modelling and geographically representative monitoring of levels of mercury in vulnerable populations and biotic media such as fish, marine mammals, sea turtles and birds. • 19.1c refers to assessments of the impact of mercury on human health and the environment, in addition to social, economic and cultural impacts, particularly in respect of vulnerable populations.	• [[add something here on 5 and 8]] • Studies and reports on the interlinkages between climate change and ocean acidification, mercury levels in the environment, and biodiversity.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
	acidification, mercury cycling, long-range transport and fate, and biodiversity loss are complex and not well understood but evidence shows that they reinforce each other and cause further damage to human health and the environment. • Research suggests that a surge in mercury pollution as terrestrial deposits of old mercury pollution are released by climate change. As global temperatures continue to rise, the thawing of permafrost is accelerated and mercury trapped in the frozen ground is now being released.			
Target 9. Ensure that the **management and use of wild species are sustainable**, thereby providing social, economic and environmental benefits for people, especially those in vulnerable situations and those most dependent on biodiversity, including	• ASGM is often associated with areas of high biodiversity importance. The direct and indirect impacts of mercury use in ASGM can pose challenges to sustainable development and the conservation of wild species. While ASGM is	• Mainstream coherent mercury and biodiversity action into national policies. • Engage Indigenous peoples and local communities to reform the ASGM sector and, where appropriate, combat illegal ASGM activities to improve the sustainable management	• The preamble of the Minamata Convention recognizes the vulnerability of Indigenous communities to the effects of mercury. • Art. 7 and Annex C contain measures to reduce, and where feasible eliminate, the use of mercury in artisanal and small-scale gold mining	• Reduction in unsustainable hunting and use of wild species associated with ASGM activities. • Increase in rehabilitation of degraded ASGM sites. • Activities to elevate the essential role of Indigenous peoples and local communities to reform the

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
through sustainable biodiversity-based activities, products and services that enhance biodiversity, and **protecting and encouraging customary sustainable use by indigenous peoples and local communities.**	often the only livelihood option for millions of people, including Indigenous peoples and local communities, it also leads to a range of negative impacts beyond those on human health and biodiversity, such as land-use change, habitat degradation, and unsustainable harvesting of wild species. • Indigenous peoples and local communities are highly dependent on biodiversity and are particularly vulnerable to mercury contamination from ASGM taking place near or in their territories. Indigenous peoples and local communities, who often are also miners, can and must play important roles in reforming the ASGM sector. They can also play important roles in supporting relevant authorities to combat illegal ASGM operations that take place on their lands and territories without their consent.	and use of wild species, while enhancing the social, economic and environmental benefits for people. Examples of initiatives include the development of alternative livelihoods that enhance biodiversity and sustainable development, formalization of miners, multi-actor cooperation to combat illegal trade of mercury and prevent the diversion of mercury from both foreign and domestic sources to use in ASGM, and by promoting the mercury-free gold supply chain (e.g., through certification schemes, recycling of gold).	and processing, including the development of national action plans and periodic reviews of the progress made in meeting obligations.	ASGM sector and combat illegal ASGM activities on their lands and territories. • Examples of measures to make the ASGM sector more sustainable, promote and scale up sustainable biodiversity-based activities and alternative livelihoods based on products and services that enhance biodiversity, and improve the gold supply chain.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
Target 10. Ensure that areas under **agriculture, aquaculture, fisheries and forestry are managed sustainably**, in particular through the sustainable use of biodiversity, including through a substantial increase of the application of biodiversity friendly practices, such as sustainable intensification, agroecological and other innovative approaches, contributing to the resilience and **long-term efficiency and productivity of these production systems, and to food security,** conserving and restoring biodiversity and maintaining nature's contributions to people, including ecosystem functions and services	• Forestry can contribute to mercury releases through leaching of mercury from soil, in particular due to use of heavy machinery in forests and clear-cutting. • Accumulation of mercury in fish and other species, including species of economic value, can have adverse environmental and socio-economic impacts, including threatening the food security of millions of people. • Some agricultural practices, such as controlled flooding and drying, can increase production of methylmercury and increase the risk of exposure of people, local wildlife and downstream ecosystems. Additionally, feeding farmed fish with feed containing high levels of mercury can lead to increased exposure for humans.	• Incorporate the impact of mercury on fish stocks, including threatened species, into the considerations for supporting the sustainable management of fisheries. • In improving the sustainability of agriculture, aquaculture and forestry, implement measures that reduce mercury methylation, bioaccumulation in the food chain, leaching from soil and export through waterbodies, and may present opportunities for activities with co-benefits within the chemicals and waste cluster.	• Art. 19.1c states that Parties shall endeavour to cooperate to develop and improve assessments of social, economic and cultural impacts of mercury and mercury compounds, particularly in respect of vulnerable populations.	• Mercury interlinkages and effects on agriculture, aquaculture, fisheries and forestry are mapped, identified and marked clearly. • Mercury monitoring in the context of agriculture, aquaculture, fisheries and forestry.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
Target 11. Restore, maintain and enhance nature's contributions to people, including ecosystem functions and services, such as the regulation of air, water and climate, soil health, pollination and reduction of disease risk, as well as protection from natural hazards and disasters, through nature-based solutions and/or ecosystem-based approaches for the benefit of all people and nature.	• Mercury pollution jeopardizes the ability of ecosystems to provide clean air and water, among other ecosystems services. • Healthy ecosystems, such as forests and peatlands, capture high amounts of particulate and gaseous mercury from the atmosphere. Healthy soils also sequester mercury and act as sinks.	• Consider and demonstrate how national and global monitoring of mercury in air and water under the Minamata Convention could contribute to Target 11 indicators. • Use ecosystem-based approaches, such as natural capital assessment, to factor in atmospheric mercury measurements into national air emissions accounts.	• Art 19.1(e) states that Parties shall endeavour to cooperate to develop and improve, taking into account their respective circumstances and capabilities Information on the environmental cycle, transport (including long-range transport and deposition), transformation and fate of mercury and mercury compounds in a range of ecosystems.	• National programs to monitor mercury in the air and water. • National accounting systems (e.g., national air emissions accounts) that reflect the cost of mercury pollution.
Target 12. Significantly increase the area and **quality**, and connectivity of, access to, **and benefits from green and blue spaces in urban and densely populated areas sustainably**, by mainstreaming the conservation and sustainable use of biodiversity, and ensure biodiversity-inclusive urban planning, enhancing native biodiversity, ecological connectivity and integrity, and **improving human**	• Urban centres are important sources of atmospheric mercury emissions, mostly originating from fossil fuel combustion, metal manufacturing, cement production, and medical and industrial waste discharges, among others, but also from the processing of artisanally-mined gold. • Open burning of waste, which often contains discarded mercury-added products, impacts urban	• Disseminate approaches to reduce mercury use and emissions in urban areas in concert with implementation of Minamata Convention control articles. • Include mercury in air and water pollution standards and develop improved methods for comprehensive inventories of mercury emissions and releases in urban areas, which include diffuse sources and currently unknown point sources.	• Art. 8 contains provisions for controlling and, where feasible, reducing emissions of mercury and mercury compounds. • Art. 7 encompasses processing of artisanally-mined gold which often takes place in urban centres. • Art. 4 controls the manufacture, import and export of mercury-added products listed in Annex A. • The process and timeline to evaluate the effectiveness of	• Pollution standards for emissions and releases that include mercury. • Comprehensive mercury emissions and releases inventories for urban and densely populated areas. • Actions to address gold processing articulated in ASGM National Action Plans and urban planning decisions. • Actions to support management of discarded mercury-added products at the city level.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
health and well-being and connection to nature, and contributing to inclusive and **sustainable urbanization** and to the provision of ecosystem functions and services.	centres which lack sound waste management systems. • City procurement and construction policies can support mercury pollution control, such as with respect to cement, lighting, and health care products. • The effectiveness evaluation of the Convention relies on accurate and quantitative mercury emissions inventories. The emissions inventories of most countries are based on emissions from point sources. However, emissions from diffuse sources can make up a large share of the overall emissions but remain poorly characterized. • Lakes and freshwater bodies in urban and densely populated areas are important for human well-being and connection to nature. Yet, the energy and industrial sectors are among the largest	• Share latest information from emissions inventories to support the effectiveness evaluation of the Convention and contribute to the GBF. • Improve methods to determine mercury concentration in surface waters in urban and densely populated areas.	the Convention is articulated in Art. 22.	• Outcomes of the Open-ended Scientific Group pertaining to trends in emissions and releases in urban and densely populated areas. • Examples of mercury and biodiversity mainstreaming into urban planning. • Studies on mercury in surface waters in urban and densely populated areas.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
	contributors to mercury pollution in freshwater bodies.			
Target 14. Ensure the full **integration of biodiversity** and its multiple values **into policies, regulations, planning and development processes, poverty eradication strategies, strategic environmental assessments, environmental impact assessments** and, as appropriate, national accounting, within and across all levels of government and across all sectors, in particular those with significant impacts on biodiversity, progressively aligning all relevant public and private activities, and fiscal and financial flows with the goals and targets of this framework.	• Mercury enters the environment from various anthropogenic sources and processes across sectors and can have significant impacts on biodiversity. For example, gold mining, both industrial and ASGM, leads to deforestation and defaunation, low soil carbon, loss of ecosystem services, removal of fine sediments, and mercury contamination of soil, water, and air. • Integration of coherent biodiversity and mercury action in policies and regulations, planning and development processes, poverty eradication strategies, strategic environmental assessments, environmental impact assessments can generate multiple co-benefits.	• Promote coherent development and implementation of national plans for biodiversity and mercury action. • Mainstream mercury and biodiversity positive action across different levels of government (e.g., national and sub-national) and across all sectors. • Ensure that rigorous environmental impact assessments of activities and processes that can lead to high emissions and releases of mercury are conducted, e.g., before permits are issued, and monitor for and redress contamination of water courses or terrestrial areas with mercury.	• Articles. 3.3 and 3.4 require banning mercury mining within given timeframes. • Art. 7.2 requires Parties to take steps to reduce, and where feasible eliminate, the use of mercury and mercury compounds in, and the emissions and releases to the environment of mercury from artisanal and small-scale mining and processing using mercury.	• Mercury and biodiversity positive action coherently mainstreamed across government levels and sectors. • Examples of barriers removed to promote mercury and biodiversity positive action in a coherent manner..

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
Target 15. Take **legal, administrative or policy measures to encourage and enable business**, and in particular to ensure that **large and transnational companies and financial institutions**: (a) Regularly monitor, assess, and transparently disclose their risks, dependencies and impacts on biodiversity, including with requirements for all large as well as transnational companies and financial institutions along their operations, supply and value chains, and portfolios; (b) Provide information needed to consumers to promote sustainable consumption patterns.	• Mercury emissions are part of the risks, dependencies and impacts on biodiversity of businesses, particularly, in the energy, mining and manufacturing sectors. • Policy reforms can set the requirements for large and transnational companies and financial institutions to reduce and monitor mercury emissions along their operations, supply and value chains, and portfolios and to provide information to promote sustainable consumption patterns.	• Ensure that mercury is factored in regular monitoring, assessment and disclosure of risks, dependencies and impacts on biodiversity in the of large and transnational companies and financial institutions.	• Part I of Annex B on "Manufacturing processes in which mercury or mercury compounds are used" provides phase-out dates for certain processes, including chlor-alkali production (2025) and acetaldehyde production using mercury catalysts (2018) • Part II of Annex B list processes in which the use of mercury must be restricted (e.g., vinyl chloride monomer production and production of polyurethane using mercury containing catalysts). • Annex D lists point sources of mercury emissions (e.g., coal - fired power plants, non-ferrous metal production, and waste incineration facilities). • Article 7 provides an opportunity for financial sector actors to undertake due diligence in the gold supply chain.	• Number of large and transnational companies that disclose their mercury emissions. • Instances where the adverse effects of mercury on biodiversity are considered or accounted for in investment decisions.
Target 16. Ensure that **people are encouraged and enabled to make sustainable consumption choices**, including by establishing supportive	• Sustainable consumption choices can drive the reduced demand for raw materials responsible for mercury emissions and releases, including non-	• Conduct tailored and wide-reaching awareness campaigns on the impact of mercury on the environment and human health to enable consumers	• Annex D lists point sources of mercury emissions (e.g., coal - fired power plants, non-ferrous metal production, and waste incineration facilities).	• Number of ASGM miners participating in certification programmes that reduce mercury use, emissions and releases in mining.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
policy, legislative or regulatory frameworks, improving education and access to relevant and accurate information and alternatives, and by 2030, reduce the global footprint of consumption in an equitable manner, including through halving global food waste, significantly reducing overconsumption and substantially reducing waste generation, in order for all people to live well in harmony with Mother Earth.	ferrous metals (e.g., gold, lead, zinc, and copper), cement and coal, as well as mercury-containing products (e.g., batteries, fluorescent lamps, cosmetics, pesticides, thermometers, and dental amalgams). • Certification of gold may help to guide more sustainable consumer choices and provide fair compensation to certified small-scale miners who comply with environmental requirements to obtain the certification. • Mercury-added cosmetics, such as skin-lightening creams, are still widely available in spite of their global phase-out date in 2020. In addition to being a health concern, they increase environmental risk due to unsafe disposal of mercury-containing waste and illegal trade of mercury.	to make sustainable consumption choices. • Facilitate the development of certification programmes that ensure that gold is sourced responsibly, without or with reduced amounts of mercury, while supporting the development of ASGM communities and respecting the rights of Indigenous peoples and local communities. • Raise awareness about the risk of mercury in cosmetics and improve capacity of health agencies to monitor and detect products available in the market.		• Number of Indigenous peoples, local communities and other relevant stakeholders indicating that their needs and priorities with regard to the use of mercury in ASGM are being addressed. • Awareness campaigns and surveys regarding the use of mercury-added cosmetics.
Target 18. Identify by 2025, and **eliminate, phase out or**	• Some of the government subsidies that are most	• Measure the reduction in mercury emissions and	• Art. 8 and 9 contain provisions to reduce the emissions and	• Incentives provided for promotion of economic

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
reform incentives, including subsidies, harmful for biodiversity, in a proportionate, just, fair, effective and equitable way, while substantially and progressively reducing them by at least $500 billion per year by 2030, starting with the most harmful incentives, and **scale up positive incentives for the conservation and sustainable use of biodiversity**.	harmful to biodiversity also emit large amounts of mercury into the atmosphere. They include subsidies for fossil fuels, such as coal, oil, and gas. • Positive incentives can help mainstream biodiversity and mercury positive action to eliminate primary mercury mining, reform the mining of non-ferrous metals, including industrial gold and ASGM, and reduce emissions from other industrial processes that use or produce mercury.	releases as a result of phasing out of harmful incentives to fossil fuels. • Provide adequate resources and incentives to achieve the reduction or elimination of the use of mercury in ASGM (e.g., standards for and marketing of mercury-free ASGM), promote alternative sources of income, improve the supply chain of and access to the alternative products (e.g., agricultural produce, eco-tourism), and facilitate access to financial incentives that support mercury and biodiversity positive action. • Provide other positive incentives that can generate co-benefits to mercury control and biodiversity.	releases of mercury from various sources. • Art. 7 and Annex C contain measures to reduce, and where feasible eliminate, the use of mercury in artisanal and small-scale gold mining and processing, including the development of national action plans and periodic reviews of the progress made in meeting obligations. • Art. 21 on national reporting and Art. 22 on the Effectiveness Evaluation of the Convention provide opportunities to demonstrate the benefits of positive incentives.	alternatives to ASGM and techniques to reduce the use of mercury in ASGM.
Target 19. Substantially and progressively **increase the level of financial resources** from all sources, in an effective, timely and easily accessible manner, including domestic, international, public and private resources, in accordance with Article 20 of the	• Given that mercury is closely connected to ecosystem degradation and biodiversity loss, strategic investments can support the coherent implementation of the Minamata Convention and the GBF to generate co-benefits to reduce	• Develop and implement projects that seek to improve coherence across biodiversity and chemicals action, focusing on building on existing experiences and priorities from countries (e.g., GEF project on strengthening the enabling framework for biodiversity	• Provisions for financial resources and mechanism are articulated in Art. 13.	• Financial resources channelled to projects that promote biodiversity and mercury positive action, including through the GEF, Specific International Programme (SIP) to support Capacity-Building and Technical Assistance, and other sources.

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Convention, to implement national biodiversity strategies and action plans, mobilizing at least $200 billion per year by 2030 […].[19]	mercury pollution and reverse biodiversity loss.	mainstreaming and mercury reduction in ASGM in Guyana). • Increase public and private sector financing and co-financing of activities to obtain co-benefits.		• Programming directions for the nineth replenishment of the GEF Trust Fund that supports coherent implementation of the GBF and Minamata Convention.
Target 20. Strengthen capacity-building and development, access to and transfer of technology, and promote development of and access to innovation and technical and scientific cooperation, including through South-South, North-South and triangular cooperation, to meet the needs for effective implementation, particularly in developing countries, fostering joint technology development and joint scientific research programmes for the conservation and sustainable use of biodiversity and strengthening scientific research and monitoring capacities, commensurate	• Capacity-building can play an important role in implementing the Minamata Convention and the GBF in a mutually supportive manner. For instance, ASGM miners typically lack the capacity to diversify their economic activities, to minimize the amount of mercury that is emitted to the air, for example, during the burning of mercury-gold amalgam, or to rehabilitate degraded lands after mining has ceased.	• Include capacity building as a cross-cutting feature that can be applied in areas where interlinkages have been identified, such as: (i) promoting the adoption of mercury-free alternatives and control methods in the ASGM sector (supporting GBF Targets 2, 3, 7 and 14); (ii) developing capacity to monitor mercury levels and impacts on biota and wildlife to inform the reduction of risks (supporting GBF Target 7); (iii) developing and promoting sustainable diversified livelihoods, particularly in ASGM regions, in accordance with the NAP guidance pursuant to Art. 7 and the GEF-8	• Capacity-building, technical assistance and technology transfer are articulated in Art. 14.	• Capacity support provided to monitor mercury levels and impacts on biota and wildlife to inform the reduction of risks. • Capacity support provided for adoption of environmentally friendly mining techniques and remediation. • Sustainable and diversified sources of income adopted by mining communities. • Minamata Convention financial mechanism projects funded under the Specific International Programme that integrate activities to support the GBF goals and targets.

[19] The full text of Target 19 is available at: https://www.cbd.int/gbf/targets/.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
with the ambition of the goals and targets of the Framework.		Biodiversity Focal Area Strategy.		
Target 21. Ensure that the **best available data, information and knowledge are accessible to decision makers, practitioners and the public** to guide effective and equitable governance, integrated and participatory management of biodiversity, and to strengthen communication, awareness-raising, education, monitoring, research and knowledge management and, also in this context, traditional knowledge, innovations, practices and technologies of indigenous peoples and local communities should only be accessed with their free, prior and informed consent, in accordance with national legislation	• Given that mercury is closely connected to ecosystem degradation and biodiversity loss, awareness raising and education should consider addressing the challenges jointly.	• Integrate knowledge management, public awareness and education efforts to improve understanding among decision makers and stakeholders about the interconnections between biodiversity and mercury pollution, leading to more informed policy making and public engagement.	• Art. 18.1b requires Parties, within their capabilities, to promote and facilitate education, training and public awareness related to the effects of exposure to mercury on human health and the environment in collaboration with relevant IGOs, NGOs, and vulnerable populations.	• Activities taken to demonstrate and elevate the interconnections between biodiversity loss and mercury pollution.
Target 22. Ensure the full, equitable, inclusive, effective and gender-responsive representation	• Indigenous peoples and local communities are particularly vulnerable to the effects of mercury	• Ensure that Indigenous Peoples and local communities, including women and children among	• The preamble of the Convention highlights the particular vulnerabilities of Arctic ecosystems and	• Activities and programmes that engage Indigenous Peoples and local communities,

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
and participation in decision-making, and access to justice and information related to biodiversity by indigenous peoples and local communities, respecting their cultures and their rights over lands, territories, resources, and traditional knowledge, as well as by women and girls, children and youth, and persons with disabilities and ensure the full protection of environmental human rights defenders.	pollution originating both from point sources and long-range transport. • Enhancing the participation of Indigenous peoples and local communities in the implementation of the Minamata Convention will also contribute to the GBF goals and targets.	them, have responsive representation and participation in decision-making and access to justice and information related to impacts of mercury on biodiversity, including their traditional sources of food. • Include, in the NAPs, strategies to prevent the exposure of vulnerable populations, particularly children and women of child-bearing age, especially pregnant women, to mercury used in ASGM. • Ensure the effective engagement of Indigenous Peoples, local communities and other relevant stakeholders in the development and implementation of NAPs.	Indigenous communities because of the biomagnification of mercury and contamination of traditional foods, and concerns about Indigenous communities more generally with respect to the effects of mercury. • Measures to reduce the risks to human health and the environment from the release of mercury and its compounds to the environment are articulated in Art. 16. Article 18 on public information, awareness and education, article 19 on research, development and monitoring and article 22 on effectiveness evaluation also refer to the needs of vulnerable populations. • Annex C identifies measures to reduce, and where possible eliminate, mercury use in ASGM. • Both components of the financial mechanism established per Art. 13 address gender aspects in projects.	• NAPs and Art. 7 reviews that demonstrate effective participation of Indigenous peoples, local communities and other relevant stakeholders. • Mercury monitoring and awareness raising programmes for Indigenous peoples and local communities. • Gender indicators in financial mechanism projects. • Gender indicators based on gender action plan to be discussed at COP-5.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
Target 23. Ensure gender equality in the implementation of the Framework through a gender-responsive approach, where all women and girls have equal opportunity and capacity to contribute to the three objectives of the Convention, including by recognizing their equal rights and access to land and natural resources and their full, equitable, meaningful and informed participation and leadership at all levels of action, engagement, policy and decision-making related to biodiversity.	• Women and girls are particularly vulnerable to the effects of mercury pollution originating both from point sources and long-range transport.	• Ensure that the application of a gender-responsive approach takes into consideration risks related to mercury-contaminated soil and water in efforts to ensure equal rights and access to land and natural resources. • Enhance training on incorporating gender aspects into project proposal development and project implementation.	• The preamble highlights health concerns, especially in developing countries, resulting from exposure to mercury of vulnerable populations, especially women, children, and, through them, future generation. • NAPs must include strategies to prevent the exposure of vulnerable populations, particularly children and women of child-bearing age, especially pregnant women, to mercury used in ASGM (Annex C, Art. 1i)	• Activities and programmes that recognize the equal rights of women and informed participation and leadership at all levels of action, engagement, policy and decision-making related to mercury and biodiversity positive action. • NAPs and Art. 7 reviews that demonstrate effective participation of women and children. • Gender indicators based on gender action plan to be discussed at COP-5 • Mercury monitoring and awareness raising programmes for women and girls.
Section J: Responsibility and transparency: a) National biodiversity strategies and action plans; b) National reports and other indicators in the monitoring framework of the GBF.	• The Minamata Convention and other MEAs have provisions for the development of thematic national action plans (e.g., NBSAPs under the CBD, NAPs under the MC) and for reporting on implementation at national level. National action plans and national reports on	• Identify areas for aligning the development of national action plans. • Identify areas in national reports that are of relevance to the Minamata Convention and other MEAs and promote the exchange of information. • Identify areas for aligning and exchanging knowledge	• Parties may develop and execute an implementation plan (Art 20). • Parties must submit national reports regularly (Art. 21)	• Collaboration between national focal points of relevant MEAs in preparation of national action plans and national reports. • NBSAPs and other biodiversity-related national action plans that include mercury control measures.

GBF Targets (in numerical order)	Relevance of and to the implementation of the Minamata Convention	Possible activities to generate co-benefits to the Minamata Convention and the GBF	Relevant articles of the MC	Indicative possible joint indicators
	implementation can provide opportunities to demonstrate the added value from implementing the Minamata Convention and the GBF in a coherent and mutually supportive manner.	related to data collection and monitoring efforts. • Improve communication among national focal points and government agencies responsible for the biodiversity, and chemicals and waste agendas.		

6. Conclusions, opportunities, barriers and recommendations

6.1. Concluding remarks

The implementation of the Minamata Convention and that of the GBF have the potential to be mutually supportive and to generate co-benefits. Five core provisions of the Minamata Convention as possible entry points for enhancing the contribution to and from the GBF:

(a) Artisanal and small-scale mercury mining (Art. 7)

(b) Assessment of impacts of mercury on the environment (Art. 19.1c)

(c) Monitoring the presence and movement of mercury in the environment (Art. 22.2 and Art. 19.1b)

(d) Assessment of human health, social, economic and cultural impacts, particularly in respect of vulnerable populations (Art. 16 and Art. 19.1c)

(e) Remediation of mercury contaminated sites (Art. 12)

The study found that, to some extent, Parties are already applying coherent approaches to combat biodiversity loss and mercury pollution. The results showed that the 20% and 16% of Parties to the CBD have provided information related to mercury, in their sixth national reports or in their national biodiversity strategies and action plans, respectively. By and large, most of the information provided in those documents focused on the impacts of mercury arising from gold mining, mostly artisanal and small-scale, on biodiversity and ecosystems, including freshwater, oceans, coastal areas, soil, air, forests and marshes. Other information provided related to monitoring of mercury in animals and the environment, the use of mercury-related indicators, contamination of the food chain, and the creation of protected areas or forested "buffer zones" around lakes and watersheds to reduce the amount of mercury being released into waterbodies, among other topics.

The study also found that risks and impacts from mercury on biodiversity and ecosystem services were mentioned in 68% of the national action plans for artisanal and small-scale gold mining. The impacts mentioned included deforestation caused by clearing of vegetated areas and erosion, deterioration of water courses and aquatic life, land degradation, wildlife decline and undermining of conservation efforts, among others, primarily as a result of artisanal and small-scale gold mining and emissions and releases of mercury. In regard to national reports under article 21, term biodiversity is rarely used but different components of biodiversity are addressed, in particular species in context of monitoring activities in the context of article 19.

Much of the information reported by the respective Parties to the Minamata Convention and CBD could be useful in identifying best practices or promising approaches that could be scaled up to contribute to biodiversity efforts and reduce mercury pollution and generate co-benefits across the agendas. For example, a socio-economic cost-benefit analysis of artisanal and small-scale gold mining using mercury that was conducted as part of the Minamata initial assessment of one Party can be a useful tool for scaling up.

6.2. Opportunities to generate co-benefits

The study analysed each of the GBF targets to identify opportunities for contribution through the implementation of the Minamata Convention. The study showed direct links between the Minamata Convention and the GBF through 21 out of the 23 Targets. This mapping provides important entry points through which the Minamata Convention can contribute to the GBF goals. Unsurprisingly, many GBF

targets also provide opportunities for contribution from the implementation of the GBF to the objective of the Minamata Convention.

Among the targets aiming at reducing threats to biodiversity (Targets 1-8), Target 7 is focused on pollutions from all sources. The aim of Target 7 to reduce by half the overall risk posed by highly hazardous chemicals provides a straightforward entry point for contribution from and to the Minamata Convention. Target 2 focuses on restoration of degraded ecosystems, including terrestrial, inland waters, and coastal and marine ecosystems. This would be another opportunity for contribution from and to the Minamata Convention as restoration can result in lower mercury mobility and toxicity.

Opportunities to generate co-benefits across biodiversity and mercury action were also identified among the targets aiming at meeting people's needs through sustainable use and benefit-sharing (Targets 7-13) and among the tools and solutions for implementation and mainstreaming (Targets 14-23). Examples of possible contribution from and to the Minamata Convention include, among others: Target 11 on actions related to maintaining air and water quality; Target 14 on the full integration of biodiversity and its multiple values into policies, regulations, planning and development processes, strategic environmental assessments, environmental impact assessments within and across all levels of government and across all sectors; Target 18 on actions to progressively phase out or reform subsidies that harm biodiversity; Target 22 to ensure the full, equitable, inclusive, effective and gender responsive representation and participation in decision-making, and access to justice and information related to biodiversity by Indigenous Peoples and local communities.

Furthermore, the study identified examples of possible indicators that could be used to monitor the contribution of the Minamata Convention to the GBF, and vice-versa. The study noted that the effectiveness evaluation of the Convention through the work being undertaken by the Open-ended Scientific Group and the Effectiveness Evaluation Group, once established,[20] as well as other ongoing initiatives, such as national reporting under article 21, will generate information that could contribute to monitoring progress against the GBF targets. Because the processes through which the information will be generated are already established, collecting the information would not be expected to pose additional burden to Parties.

A summary overview of the possible entry points for harnessing the mutual contribution and co-benefits arising from the implementation of the Minamata Convention and the GBF, along with possible indicators to monitor that contribution, is provided in table 5. The table serves as a reference for the development of targeted interventions by Parties and other governments wishing to improve coherence across the Minamata Convention and the GBF.

6.3. Knowledge gaps and barriers

In regard to the monitoring efforts to measure progress towards the GBF targets, the report noted that it is essential that the metrics chosen are flexible and comprehensive to encompass the full range of actions that can meaningfully contribute to each target. In this regard, the report also noted that although Target 7 concerns pollution from all sources, including highly hazardous chemicals, the "headline indicators" (highest indicator level) for monitoring Target 7, as adopted by COP 15, only focus on pollution caused by nitrogen and pesticides, while the "component indicators" and "complementary indicators" (optional medium and lower indicator levels, respectively) are only marginally relevant to mercury pollution.

[20] The Effectiveness Evaluation Group is expected to be established at the fifth meeting of the Conference of the Parties to the Minamata Convention.

Furthermore, the report identified gaps in knowledge, financial resources and capacity of Parties in relation to assessing the impacts of mercury on biodiversity and ecosystem functions and services, promoting integration of mercury- and biodiversity-related priorities to support the development and implementation of coherent policies across sectors, preventing artisanal and small-scale gold mining using mercury in areas where the activity is deemed illegal as per national legislation, and monitoring mercury levels and impact in vulnerable populations, including Indigenous Peoples and local communities, as well as in threatened species that are likely to be exposed to high levels of mercury through their diet, among others.

6.4. Recommendations

In order to support integration and coherence between mercury and biodiversity action by governments and other stakeholders, at sub-national, national and international levels, one of the recommended next steps is the development of a roadmap, under the Minamata Convention, that outlines and prioritizes impact-driven actions that are supportive of the objective of the Minamata Convention and of the goals and targets of the GBF. The roadmap could focus on and build upon existing and planned actions to reduce the exposure of, and impact on biodiversity and ecosystem services of the use of mercury in ASGM, mainstream biodiversity and mercury control measures into coherent policy development and implementation, improve research on the impacts of mercury on biodiversity and ecosystem services, monitor impacts on biodiversity and health by utilizing and adapting existing monitoring programmes, restore degraded land and water bodies, and implement sound waste management. To this end, the Secretariat could be tasked take relevant action, which could include the circulation of a notification to Parties and/or the organization of webinars to collect and synthesize information from Parties and other stakeholders on their experience, in particular to and identity good practices, gaps and challenges for joint implementation, to help inform the development of the roadmap for consideration by the Conference of the Parties to the Minamata Convention at its sixth meeting.

The national biodiversity strategies and action plans (NBSAPs) are expected to be a key component of the enhanced planning, monitoring, reporting and review mechanism for the GBF. To this end, this study recommends that Parties and other governments to the CBD, as appropriate, could reflect their goals for national mercury reduction and control measures while revising and updating NBSAPs in accordance with the guidance provided in annex I to decision 15/6.

The findings of the study also highlighted the importance of aligning data collection and monitoring efforts to support better coordination between biodiversity monitoring and mercury-related monitoring to improve understanding of the impacts of mercury on biodiversity. In this regard, additional indicators to monitor progress in achieving Target 7 and other targets of the GBF would be necessary to enable those Parties, other governments and relevant stakeholders, who wish to do so, to fully capture the contribution from and to the Minamata Convention. The report recommended that the ad hoc technical expert group, which was mandated by the CBD COP to revise the indicators for monitoring the GBF, could consider adding one or more indicators related to the amount of highly hazardous chemicals entering the environment (as headline indicator) and to the amount of mercury and entering the environment from anthropogenic sources and mercury levels in people and animals (as optional component indicators).

The Open-Ended Scientific Group of the Minamata Convention, which was established at the fourth meeting of the COP to the Minamata Convention, has been tasked to compile, analyse and synthesise comparable mercury monitoring data on changes in mercury concentrations in environmental media, biotic media and the human population, including vulnerable populations. It is recommended to invite the Open-Ended Scientific Group to develop indicators to be used to track the contribution of the Minamata Convention to biodiversity as part of the indicators to support the effectiveness evaluation of the

Convention. Moreover, the Effectiveness Evaluation Group–the policy body for the development of the effectiveness evaluation of the Convention–could be invited to consider biodiversity aspects during the effectiveness evaluation of the Minamata Convention.

The study also noted the important role that the Global Environment Facility could play in maximizing synergy and coherence across biodiversity and mercury action at national level by promoting integrated and innovative solutions, including for reducing or eliminating the use of mercury in ASGM in areas of high biodiversity value, as well as piloting solutions to create sustainable livelihoods as alternatives to ASGM, to reduce the amount of mercury entering water bodies, and to utilize knowledge of Indigenous Peoples and local communities in efforts to monitor mercury in the environment. In this regard, it is recommended that the Global Environment Facility maximizes co-benefits across focal areas by, for example, integrating mercury action into programmes and projects developed under the Biodiversity Focal Area and integrated programmes of the eighth replenishment of the Global Environment Facility Trust Fund, including scaling up mercury-reducing technologies and sustainable livelihoods as alternatives to ASGM in the Amazon, Congo, and Critical Forest Biomes Integrated Program, as well as through the new Global Biodiversity Framework Fund.

With regard to international cooperation, it is recommended that relevant discussions and decision-making at the international level on enhancing coherence among the biodiversity-related MEAs, fully take into account the chemicals and waste MEAs, including the Minamata Convention. For example, the organization of the Bern III consultation workshop on biodiversity-related MEAs is of particular relevance and could be thematically expanded from biodiversity to include chemicals and waste, including mercury, given their interconnected nature. This could enable strengthen understanding of commonalities across the thematic MEA clusters, thus enabling to implement jointly activities that intersect the MEAs. To this end, the Biodiversity Liaison Group (BLG) could be invited to include the Minamata Convention, given its critical role in protecting biodiversity. Consequently, it is recommended that Secretariat could cooperate with other biodiversity related multilateral environmental agreements and intergovernmental organizations and support the thematic discussions of the Liaison Group of Biodiversity-related Conventions, including those facilitated by the Bern process.

The linkage between biodiversity and mercury could be more strongly featured in the work of relevant science-policy bodies and assessments to better contribute to the understanding and mitigation of mercury's impact on biodiversity. Enhancing the contribution from the interlinkages between the Minamata Convention and GBF may also take into account the possible contribution and involvement of other relevant biodiversity-related MEAs. Examples include:

(a) The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) considers the impacts of different pollutants, including heavy metals, in its assessments, but could give stronger emphasis to mercury by explicitly addressing its impacts on biodiversity, ecosystem services, and human well-being.

(b) The Global Mercury Assessment addresses the ecological implications of mercury, but could give stronger emphasis to biodiversity with inclusion of biodiversity indicators or enhanced ecological case studies.

(c) The International Whaling Commission's long-term monitoring efforts have helped provide valuable data and scientific insights into the distribution, levels, and trends of heavy metals in the oceans, including mercury. Sharing information on the levels of mercury in cetaceans could be supportive of the IWC and support the effectiveness evaluation of the Minamata Convention.

(d) Cooperation with secretariats of the Ramsar Convention on Wetlands and the Convention on Migratory Species to evaluate the impact of mercury on migratory species and improve understanding of how migratory species contribute to long-range transport and cycling of mercury.

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Annex 1. Compilation and summary of mercury-related activities in CBD national reports.

Table A. Compilation of mercury-related activities reported in in CBD national reports.

Country	Reference to mercury in CBD national reports
Azerbaijan	4th national report • Section on pollution mentions that no technologies are applied in utilization and treatment of many **hazardous wastes**, including mercury lamps (p. 47)
Belize	4th national report • Highlights that a high level of **mercury contamination** in fish has a high economic and social cost
Brazil	6th national report • Section on pollution mentions that National Solid Waste Policy establishes the shared responsibility for the products' life cycle. Until the end of 2018, seven reverse logistics agreements had been implemented, including for fluorescent light bulbs of sodium and mercury vapor and mixed light (p. 88). 5th national report • Mentions that Tucuruí hydroelectric project has resulted in contamination of the food chain with methyl-mercury. This increases risk of mercury methylation and its introduction in the food chain, resulting in intoxication cases among river-side communities and Indigenous Peoples in the region. (p. 146).
Bulgaria	5th national report • Under Target 8 (pollution), the subsection on ambient air pollution mentions that an Inventory of airborne hazardous substances emissions is carried out for 11 groups of emission sources, including heavy metals (mercury, cadmium, tin) (p. 94) 1st national report • The ministry has partnered with an NGO called Ecoglasnost to collect information about the contamination of soil and water with arsenic and mercury.
Canada	5th national report • The concentration of mercury is increasing in some wildlife in some areas. Mercury trends for seabirds are illustrated for 1973-2012, which shows that mercury concentrations almost doubled in thick-billed murres during that period (p. 12 and p. 27). • Anthropogenic sources of mercury include the burning of fossil fuels, nonferrous metal production and waste incineration, but also large-scale hydro-electric developments can also increase methyl-mercury in the food chain. As these activities increase globally, Arctic concentrations of mercury have also increased. (p. 27-28) 4th national report • The recovery of the caribou population is hindered, inter alia, by long range transport of chemicals, such as mercury (p. 22) • Trends on mercury levels in wildlife show an increasing level over time for thick-billed murre eggs (p. 32) • Since the mid-1970s, increases in mercury have been observed in northern Canada in some marine mammals, seabirds, fish and some terrestrial mammals (Porcupine and Bluenose caribou herds (p. 33) • A summary table with indicators is included in the end, with indicators for pollution showing some increases for contaminant concentrations in biota (e.g. mercury) (p. 136) 3rd national report • The section regarding systematic monitoring programmes (Art 7c) mentions that the National Air Pollution Surveillance (NAPS) Network uses filters to analyze 50 elements, including toxic metals such as arsenic, lead and mercury (p. 29)
China	4th national report • Trends of discharges of toxic pollutants in sewage in China between 1998-2006 shows that mercury concentrations have been constantly low (p. 62) 3rd national report • The section on monitoring programmes (Art 7b) states that the nationwide network of environmental monitoring of offshore areas monitors 16 items, including mercury (p. 88).

Country	Reference to mercury in CBD national reports
Czech Republic	4th national report • Soil quality is negatively influenced by some anthropogenic activities as utilization of sludge from wastewater treatment plants, with high levels of mercury and other heavy metals (p. 15)
Democratic Republic of Congo	6th national report • Mentions that a project was executed to **develop a Mercury Initial Assessment and ASGM action plan** to facilitate the Ratification and rapid implementation of the Minamata Convention using knowledge and scientific and technical tools developed by national actors (p. 48)
Denmark	4th national report • The presence of heavy metals such as cadmium and mercury and chlorinated organic compounds are found in high concentrations in the tissue of arctic organisms (p. 89) 5th national report • In conjunction with the conservation status of the sea, mentions that concentrations of mercury in fish have been falling slightly in Øresund, where discharges from Copenhagen in the past were high due to inadequately purified wastewater. By comparison, concentrations of mercury in fish in the Great Belt have remained stable since 1980. (p. 39)
Eritrea	6th national report • Mentions that in 2018 an inventory on mercury was done to identify the usage of mercury, supply sources and assess its environmental and health impacts, which will be followed by the development of a National Action Plan (p. 60)
Fiji	4th national report • Section on threats to biodiversity (pollution and water quality) states that levels of heavy metals in Suva Harbour are also high and are equal to the most polluted harbours in Australia. Lagoonal sediments and shellfish from the Lami area have high levels of mercury, zinc and lead. 1st national report • In context of the status of the marine environment, it is mentioned that levels of heavy metals in Suva harbour are also high, and are equal to the most polluted harbours in Australia. Lagoonal sediments and shellfish from the Lami area have high levels of mercury, zinc and lead. (p. 11)
Germany	5th national report • States that according to OSPAR Quality Status Report published in 2010, there has already been a marked reduction in emission levels for heavy metals (lead, mercury, cadmium) in the ocean (p. 96)
Ghana	6th national report • Section regarding the contribution of Indigenous Peoples and Local Communities mentions that activities of illegal gold miners in Ghana has been threatening to aquatic biodiversity as the use of heavy metals such as mercury has been used in the alluvial gold mining process (p. 159)
Guinea-Bissau	6th national report • States that after the ratification of the Minamata Convention and a mercury initial assessment was carried out (p. 74)
Guyana	6th national report • States that the most common examples of resource contamination were water pollution from mercury, cyanide and other chemical wastes resulting from Bauxite and gold mining industries (p. 4) • States that two mercury-related projects have been submitted for GEF approval: 1) A Gold/ Supply Chain Approach to Eliminating Mercury in Guyana's ASGM Sector: El Dorado Gold Jewellery Made in Guyana, 2) Strengthening the Enabling Framework for Biodiversity Mainstreaming and Mercury Reduction in Small and Medium-scale Gold Mining Operations (p. 35) • Under Target 8 (pollution) it is mentioned that mercury use remains active in Guyana. The goal is to gradually phase-out its use by 2027. The section describes the development of a mercury Initial assessment that lays the foundation to prepare a national implementation plan. Activities include testing and demonstration of mercury free mining technology to miners. Figure 8 shows total estimated emissions and releases of mercury from Guyana's Anthropogenic sources (p. 77-78) • A national target is established for phasing out the use of mercury to reduce contamination of water in mining areas, including establishing protected areas to ensure protection of watershed (p. 112) 5th national report • States the GEF' Small Grants Programme has supported the reduction of the use of mercury in gold mining and jewellery production (p. 25)

Country	Reference to mercury in CBD national reports
	• The section on status, trends and threats to biodiversity highlights freshwater ecosystems are under severe stress due to mining activities. For instance, increased levels of mercury in the sediments of parts of the Potaro River Basin appear to have their origin in gold mining activities (p. 29). 1st national report • Section on major causes of biodiversity loss mentions that mining has caused water quality degradation that needs to be combatted by phasing out mercury in fluvial mining operations (p. 6)
Indonesia	3rd national report • The section on impact assessment and minimizing adverse effects (Art 14) states the cooperation is ongoing with Germany-GTZ among others on mercury recapture from gold mining activities (p. 110)
Iraq	6th national report • The report mentions that a "by 2017 a national monitoring programme is established for identification of the types of pollutants, the sources and diffusion paths." In this context it is mentioned that various metals have been found to be present in the fish tissues at levels which exceeded those permitted by WHO/FAO particularly for lead, mercury and zinc (p. 116) 5th national report (2014) • Ongoing projects include Environmental assessment of mercury pollution in Iraq to fulfill Aichi Biodiversity Target 8 (p. 106) 4th national report • States that in Al Suwaira is a pesticides warehouse complex that stores 76 tons of mercury-based pesticides (p. 115) 1st national report • Appendix 4 includes national indicators used in the report, including an indicator on polluted & hazardous sites. One of the priority sites Al Suwaira - a pesticide warehouse complex contains 76 tons of mercury-based pesticides (p. 141)
Israel	5th national report • Main threats to biodiversity include pollution in the Mediterranean Sea, which includes a recent increase of mercury concentrations that has yet to be explained in fish of north of Haifa Bay (p. 41)
Kazakhstan	6th national report • Measures taken for meeting the national target to reduce pollution include liquidation of mercury-containing wastes in Karaganda oblast (p. 62). 5th national report • States that the content of mercury decreased by 29.3% in crude wastewater discharged into water bodies from 2009-2012 2nd national report • Mentions that Kazakhstan is developing the draft project of purification Nura River from mercury compounds in bottom sediment. (p. 3)
Kenya	6th national report • Under target 8 (pollution), it is mentioned that on the Tanzania side small- and large-scale gold mining activities rely on toxic chemicals, such as cyanide, arsenic and mercury which can end up in the Mara River (p. 161) • Indicators used to follow-up Target 8 includes trends in mercury emissions (p. 161)
Kiribati	6th national report • Mentions that a mercury initial assessment has been carried out that supports the achievement of the Aichi Biodiversity Targets 1, 5, 8, 11 and 19 (p. 80)
Lebanon	4th national report • The section on marine biodiversity conservation states that recently a project has been developed to measure mercury level in precipitation (rain and snow) (p. 76)
Lesotho	6th national report • States that a Mercury release inventory project was undertaken (p. 18) • Measure for pollution control include the ratification and early Implementation of the Minamata Convention, including identification & quantification of stock piles and streams; legal instruments gap analysis completed; identification of vulnerable groups to mercury; development of guidance document on contaminated sites identification; capacity building of district environment officers on identifying mercury;

Country	Reference to mercury in CBD national reports
	contaminated sites; mapping hot spots; Lesotho mercury situation analysis report compiled; and sensitization of society on dangers of mercury. (p. 50)
Malta	5th national report • Monitoring of water quality in aquatic systems shows good results for costal water for all parameters monitored in water, except for mercury which is the most common metal detected in the water column from all the sampling stations (p. 171) 4th national report • Section under air quality mentions that in 2007 a report was presented on a preliminary assessment of arsenic, cadmium, nickel and mercury in the air (p. 87)
Mongolia	5th national report • Mentions activities taken to remediate mercury-contaminated land, including their burial and neutralization (p. 86) • A list is provided of most common air pollutants form fixed sources, including mercury (p. 65) • National indicators developed for meeting Target 8 includes "Emissions of air pollutants from stationary sources (mercury)", which shows an increasing level from 2012 (0.2 tons) to 2015 (0.5 tons). (p. 151-152) 4th national report • Section on mining industry states that gold and other mining activities, particularly the exploitation method of heavy use of extremely poisonous chemicals such as mercury and cyanide, have casted dark shadow on the environment including soil erosion and withered rivers and streams (p. 75).
Mozambique	5th national report • Artisanal gold mining poses serious environmental and health problems to miners and local communities in the Manica province. Mercury has contaminated watercourses, including due to pollution from mining, a South African gold mining company operating in Manica province that had their activities suspended because of being discharging waste into river Róvué (p. 72-73)
Myanmar	4th national report • The section on inland water biodiversity mentions that threats to freshwater dolphins includes excessive sedimentation and mercury and noise pollution caused by large gold mining dredges and shoreline blasting operations (p. 33)
Namibia	6th national report • States that progress towards Target 8 (pollution) includes ratification of the Minamata Convention and completion of a mercury inventory (p. 75)
Nicaragua	6th national report • Small and medium-sized industrial facilities that provide processing services to artisanal miners are trained in how to reduce risks to health and environmental pollution caused by the use of mercury (p. 88)
Norway	5th national report • Section on fresh water mentions that long-range transport of pollutants has resulted in detectable cadmium, lead and mercury pollution in the southern half of Norway, and mercury levels are so high that people are advised not to eat large predatory fish in certain areas (p. 32)
Pakistan	5th national report • Threats to biodiversity include discharge from thermal power plants is a cause of major concern as in addition to the mercury poisoning, high water temperature of discharge results in death of aquatic life and degradation of the inland water and marine ecosystems. (p. 12)
Papua New Guinea	6th national report • Under Target 8 (pollution) it is mentioned that Papua New Guinea is one of the 18 countries to impact coastal areas with mine tailings disposal, raising concern of heavy metal contamination (p. 77) • Alluvial mining is extensive with some use of mercury which requires regulation. The volume of its use and escape into the local environment is not known or monitored. No steps have been taken to determine whether to ratify the Minamata Convention (p. 78)
Peru	1st national report • The use of mercury in gold mining seriously pollutes water and has removed about 81.000 hectares of forest edging riverbeds in the area, especially in the Department of Madre de Dios, which is located in the midst of the Peruvian rainforest (p. 45)
Philippines	4th national report

Country	Reference to mercury in CBD national reports
	• Threats include tailings from small scale miners using mercury (from processing of gold), pose as direct threats to croplands and water systems, and indirectly threaten forest biodiversity. A report from 2001 shows that some 140 tons of mercury is released to the environment by small scale miners (p. 23) • Mercury pollution is also a threat to marshes where traces of mercury have been recorded in sediments, plants and fish upstream and downstream of the marsh (p. 45)
Poland	4th national report • Threats include emissions of particularly hazardous heavy metals, i.e. cadmium, lead, and mercury, that have steadily decreased (p. 48)
Portugal	1st national report • Dangers associated to the consumption of fish include accumulation of a diverse range of environmental contaminants, including mercury (p. 34)
Republic of Congo	6th national report • Mercury emissions and releases are used as an indicator for Target 8 on pollution (p. 30) • The decree of November 17, 2003 defines the sampling method and analytical methods for the official control of lead, cadmium and mercury in some fish products to support Target 6 (p. 51)
Romania	4th national report • Section on environmental drivers (air pollution) states that the national emission inventory shows and increase in the annual cadmium and mercury emissions due to incineration of industrial wastes (p. 16).
Samoa	6th national report • Table 19 provides NBSAP indicators to monitor progress between 2015-2020, under national target 10 (Pressures on vulnerable ecosystem minimized) it is mentioned that monitoring data of Vaiusu Bay indicates poor status of the marine environment due to presence of lead, iron, arsenic and mercury making marine species highly poisonous and not fit for human consumption (p. 64) • Measures to implement the NBSAP highlight the need to ban fishing in Vaiusu bay due to toxic concentrations of heavy metals, including mercury (p. 146)
Sierra Leone	5th national report • Section on impacts states that trace metals such as lead, cadmium, mercury and arsenic enter the sea from power plant emissions, mining and manufacturing industry. The mass mortalities of catfishes in 1992/93 along the entire coast leading to a near extinction strongly suggests a sediment-based heavy metal contamination (p. 48)
Slovenia	5th national report • Section regarding coastal and marine habitat types mentions that concentrations of hydrocarbons, cadmium and mercury in the samples of the Mediterranean mussel (Mytilus galloprovincialis) have remained stable (p. 23)
Sudan	4th national report • Threats includes chemicals used for mining (e.g. cyanide and mercury) that may have serious impacts on the coastal and marine environment (p. 36)
Suriname	6th national report • **Activities for conservation of biodiversity includes responsible mining** that has been promoted with the development of a Minamata Initial Assessment (MIA) and a National Action Plan (NAP) to reduce, and where feasible, eliminate mercury use in artisanal and small-scale gold mining (p. 27) (Target 8). • A seven-year GEF-funded project is operationalized focusing on the introduction of sustainable mining techniques, including mercury free mining in the ASGM sector through the introduction of education centres in different mining regions. The Ministry is also helping to formalize illegal miners to help align their activities with existing commitments (p. 27) (Target 4, Target 15, Target 20). • Level 1 and 2 inventories of mercury pollution have been done (p. 28) (Target 8). • National Strategic Tourism Plan aims to diversify the economic sectors in Suriname to refocus certain unsustainable practices, such as ASGM using mercury, into eco- and nature tourism (p. 61) (Target 4) • A bio-monitoring project has been carried out to research the effect of mercury and pesticides on the health of mothers and unborn children (p. 80). Monitoring also includes mercury in human samples and a number of fish species, categorized in 4 levels (p. 81) • Mercury emissions from mining have decreased due to mechanical improvements (p. 81).

Country	Reference to mercury in CBD national reports
	• Indicators used for Target 8 include "data on bio-monitoring' and 'data on fish species by mercury levels' (p. 82) • Research projects have been conducted on trends such as mercury pollution of aquatic ecosystems and impact of mining on biodiversity (target 19)
Sweden	4th national report • Mercury leaching from forest land in connection with forestry operations has attracted attention. The metals bound to the humus, such as mercury, often enter lakes and watercourses. Retaining a buffer zone, with its vegetation, around lakes and along watercourses exerts favorable effects on the aquatic environment. Forested buffer zones appear to reduce run-off by slowing the water down and through the trees' absorption of water (p. 25) 3rd national report • Aichi Target 7.2 is delivered, inter alia, with a national target to phase-out of substances of very high concern in newly manufactured finished products, including with a sub-target to be free from mercury by 2003
Switzerland	6th national report • Lead and mercury levels have increased significantly in the topsoil on the past 20 years (p. 57)
Tonga	6th national report • Threats and pressures on biodiversity includes heavy metals; threats to human health from heavy metals are usually associated with exposure to lead, cadmium and mercury. The general population of Tonga is highly exposed to heavy metals (methylmercury) via consumption of seafood. (p. 170)
Uganda	6th national report • Under Target 8, it is mentioned that the pollution standards include 53 contents of effluent[21] (standards for discharge of effluent into water or on land), including mercury (p. 108)
UK	5th national report • Tracking of hazardous substances in the marine environment shows that the level of mercury has declined 60% during 1990-2011 (p. 8)
Yemen	6th national report • Under target 8, it is recommended to include a new **biodiversity indicator** to assess trends in mercury emissions (p. 115)
Zimbabwe	6th national report • Under Target 13, it is mentioned that Zimbabwe is involved in a regional project on the development of national action plans for artisanal and small-scale gold mining (p. 142) 5th national report • More than a million people are illegally panning for gold along Zimbabwe's rivers, resulting in clearance of trees and digging in riverbeds, which cause soil erosion, landslides and siltation of water bodies and destroy aquatic biodiversity. Increased use of mercury, iron and cyanide to process ore has polluted water courses, affecting communities' sources of livelihoods. (p. 2) • Unsustainable mining practices and the use of heavy metals such as mercury have contributed to water contamination and poisoning of wildlife and livestock (p. 25) 4th national report • Section on threats to biodiversity (pollution) mentions that the proliferation of illegal gold panning activities has resulted in serious damage to aquatic fauna and riverine ecosystems. The use of cyanide and mercury for gold processing has caused pollution to water bodies. Gold panning is also contributing to the siltation of rivers and reservoirs thus reducing the volume of water a dam can hold. (p. 47)

[21] "wastewater–treated or untreated–that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters".

Table B. Summary of mercury-related activities reported in CBD national reports.

Country	Reference to mercury in CBD national reports
Azerbaijan	• Mercury described as hazardous waste, focusing on mercury lamps
Belize	• Mercury contamination of fish
Brazil	• Use of shared responsibility for mercury lamps • Hydroelectric project resulted in contamination of the food chain with mercury affecting river-side communities and Indigenous Peoples
Bulgaria	• The inventory on ambient air pollution includes mercury • Inventory of soil and water contaminated with mercury carried out
Canada	• Since mid-1970s, increases in mercury have been observed in northern Canada in some marine mammals, seabirds, fish and some terrestrial mammals • Mercury contamination of wildlife is monitored, showing that concentration of mercury almost doubled in thick-billed murres from 1975 to 2012. • Lists anthropogenic sources of mercury that lead to contamination of the food chain, including the burning of fossil fuels, nonferrous metal production and waste incineration, but also large-scale hydro-electric developments • The national monitoring programme on air pollution includes surveillance of mercury • The recovery of the caribou population is hindered due to long range transport of mercury and other chemicals • Indicator used for tracking mercury concentrations in biota
China	• Monitors concentrations of mercury in sewage water that has been constantly low
Czech Republic	• Utilization of sludge from wastewater treatment has contaminated soil with mercury
Democratic Republic of Congo	• Development of a MIA and an ASGM action plans
Denmark	• Mercury is found in high concentrations in the tissue of arctic organisms • Concentrations of mercury in fish have been falling slightly in Øresund, and remained stable in the Great Belt
Eritrea	• An inventory of mercury was carried out and an ASGM action plan was developed
Fiji	• Monitoring of levels of heavy metals shows they are high in Suva Harbour, in particular lagoonal sediments and shellfish from the Lami area have high levels of mercury
Germany	• Monitoring of heavy metals in the ocean shows decreasing levels for mercury
Ghana	• Illegal gold mining is threatening aquatic biodiversity due to the use of mercury
Guinea-Bissau	• A MIA has been carried out
Guyana	• Bauxite and gold mining is a major source for water pollution, in particular freshwater ecosystems are under severe stress due to use of mercury, cyanide and other chemicals • A goal has been established to phase out mercury use by 2027, which is combined with activities for protection of the watershed by establishing protected areas • Various GEF project on the pipeline, including "**Strengthening the Enabling Framework for Biodiversity Mainstreaming and Mercury Reduction in Small and Medium-scale Gold Mining Operations**"
Indonesia	• A project is carried out to recapture mercury from mining activities
Iraq	• A national monitoring plan for pollutants is being established, early biomonitoring results shows high levels of mercury contamination of fish • Mercury-based pesticides are stored in a warehouse complex in Al Suwaira • Polluted and hazardous sites are used as a national indicator
Israel	• Threats to biodiversity includes increasing levels of mercury monitored in the Mediterranean Sea
Kazakhstan	• Liquidation of mercury-containing wastes in Karaganda oblast carried out • Remediation of mercury from the bottom sediment of Nura river planned • Mercury content has decreased by 29% in crude wastewater
Kenya	• The Mara River is threatened by small- and large-scale gold mining activities that rely on mercury • Indicators used to track Target 8 on pollution include trends in mercury emissions

Country	Reference to mercury in CBD national reports
Kiribati	• A MIA has been carried out
Lebanon	• A project has been developed to measure mercury level in precipitation (rain and snow)
Lesotho	• Early implementation of mercury activities carried out, including inventory of stockpiles and streams
Malta	• Monitoring of water quality in the water column shows high concentrations of mercury • Mercury has been included air quality monitoring
Mongolia	• Remediation of mercury-contaminated land undertaken, including their burial and neutralization • Indicators used to track Target 8 on pollution includes "Emissions of air pollutants from stationary sources (mercury)" • Use of mercury and other hazardous chemicals in mining have resulted in soil erosion and contaminated rivers and steams
Mozambique	• Artisanal gold mining poses serious environmental and health problems to miners and local communities in the Manica Province • The activity of a gold mining company has been suspended due to contaminating watercourses with mercury
Myanmar	• Freshwater dolphins are threatened due to excessive sedimentation and mercury and noise pollution caused by large gold mining dredges and shoreline blasting operations
Namibia	• A mercury inventory has been completed
Nicaragua	• Industrial facilities that provide processing services to artisanal miners are trained to reduce risks caused by mercury use
Norway	• Long-range transport of mercury has resulted in restrictions to eat predatory fish in certain areas
Pakistan	• Discharge from thermal power plants is a cause of major concern as in addition to the mercury poisoning, high water temperature of discharge results in death of aquatic life and degradation of the inland water and marine ecosystems • https://pubmed.ncbi.nlm.nih.gov/860131/
Papua New Guinea	• Disposal of mining tailings impcats coastal areas, raising concern of heavy metal contamination, including mercury. • Mercury is used in alluvial mining, which is practiced extensively, despite lack of regulation. Moreover, the Minamata Convention remains unratified, and the use of mercury, including its releases and emissions, are unknown.
Peru	• The Department of Madre de Dios is seriously affected by gold mining that has cleated 81.000 hectares of forest edging riverbeds
Philippines	• Tailings from small scale miners using mercury (from processing of gold), pose a direct threat to croplands and water systems, and indirectly threaten forest biodiversity. • Mercury pollution is also a threat to marshes where traces of mercury have been detected in sediments, plants and fish
Poland	• Heavy metal emissions are decreasing, including mercury
Portugal	• Fishing includes risks posed by environmental contaminants, including mercury
Republic of Congo	• Indicators used to track Target 8 on pollution includes emissions and releases of mercury
Romania	• An increase in the annual mercury emissions has been detected due to incineration of industrial wastes
Samoa	• Monitoring data of Vaiusu Bay indicates poor status of the marine environment due to presence of lead, iron, arsenic and mercury making marine species highly poisonous, which will require banning fishing in the area
Sierra Leone	• Mercury enters the sea from power plant emissions, mining and manufacturing industry, which may have contributed mass mortalities of catfishes in 1992/93 along the entire coast leading to a near extinction likely due to a sediment-based heavy metal contamination
Slovenia	• Concentrations of mercury in the samples of the Mediterranean mussel (Mytilus galloprovincialis) have remained stable.
Sudan	• The storage and use of chemicals in mining activities, including mercury, poses a serious threat to the coastal and marine environment

Country	Reference to mercury in CBD national reports
Suriname	• Biodiversity conservation has been promoted with responsible mining with the development of a MIA and NAP for the Minamata Convention • A GEF project is operationalized to introduce sustainable mining techniques, including mercury free mining in the ASGM sector, through the introduction of education centres in different mining regions. • Illegal miners are formalized to help align their activities with existing commitments. • Inventories of mercury pollution have been carried out • The National Strategic Tourism Plan aims to diversify unsustainable practices, such as ASGM using mercury, into eco- and nature tourism. • A bio-monitoring project has been carried out to study effects of mercury on the health of mothers and unborn children • Indicators used to track Target 8 on pollution includes "data on bio-monitoring' and 'data on fish species by mercury levels • Research projects have been conducted on trends such as mercury pollution of aquatic ecosystems and impact of mining on biodiversity
Sweden	• Forested buffer zones around lakes used to prevent mercury from entering them, which derives from forestry operations that cause leaching of mercury from soil • Links to GBF Target 10
Switzerland	• Mercury levels have increased significantly in the topsoil on the past 20 years
Tonga	• The general population of Tonga is highly exposed to heavy metals (methylmercury) via consumption of seafood
Uganda	• Pollution standards for effluents include 53 substances, including mercury
UK	• The level of mercury in the marine environment has declined 60% during 1990-2011
Yemen	• It is recommended to include a new biodiversity indicator to assess trends in mercury emissions
Zimbabwe	• More than a million people are illegally panning for gold along Zimbabwe's rivers, resulting in clearance of trees and digging in riverbeds, which cause soil erosion, landslides and siltation of water bodies and destroy aquatic biodiversity • The use of heavy metals such as mercury in mining has contributed to water contamination and poisoning of wildlife and livestock

Annex 2. Summary of references to mercury in National Biodiversity Strategies and Action Plans (NBSAPs)

Table C. Summary of references of mercury in National Biodiversity Strategies and Action Plans (NBSAPs).

	Mercury references in the NBSAPs
Brazil 2017	• Includes an action under Target 8 for the definition of strategies to reduce the release of mercury into the aquatic habitats, based on the national inventory of mercury emissions and dumping with the objective to protect aquatic organisms through the implementation of activities for minimizing mercury dumping (p. 174)
Finland 2006-2016 and Finland 2013-2020	• Mentioned that pollutant loads in the Baltic Sea have declined, including mercury (71) • Mentioned that the concentration of mercury in the Baltic Sea has reduced (p. 86)
Guyana 2012-2020	• Increased levels of mercury detected in the sediments of parts of the Potaro River Basin (p. 25) • Adoption of innovative technologies to Improve mercury abatement in gold mining is highlighted (p. 38)
Belize 2016-2020	• Bio-accumulation of heavy metals (e.g. mercury and cobalt) in fish, crocodiles, manatees mentioned as a key consequence of pollution (p. 45)
Macedonia 2018--2023	• It is mentioned that pollution of air with heavy metals is especially notable in Veles as a result from extremely contaminated soils in the city and its surrounding with heavy metals, such as mercury (p. 77)
Mozambique 2015-2035	• Is mentioned that artisanal mining (e.g gold mining in Manica and Sofala) is one of the activities that most endangers biodiversity, since it is performed using mercury, causes deforestation and lacks rehabilitation plans (p. 44) • Under Target 7 (By 2020, catalog/systematize, disseminate and promote sustainable management practices in agriculture, livestock, aquaculture, mining, forestry and wildlife) an activity has been included to "Establish and implement sustainable management practices for small-scale mining" with the following indicator: "Number of mining operators adopting sustainable practices (e.g. use of Mercury substitutes, soil and water management, rehabilitation of mined areas, etc.)"
Suriname 2012-216	• Under the objective of conservation of biodiversity a sub-objective has been included for controlling the spread of dangerous objects, substances and organisms, including mercury (p. 28)
Norway 2000-2001 and Norway 2015-2016	• Mentions that earlier releases of heavy metals such as lead, copper, cadmium, mercury and zinc from mines and industry have harmed or wiped-out living organisms in a number of lakes and streams (p. 36) • An overview of patterns of activity and pressures discusses long-range transport of pollutants, where it is mentioned that according to estimates for inputs of mercury via ocean currents are up to 1,000 times higher than before (p. 59)
Niue 2015	• Mentioned that GEF serves as a financial mechanism for the Minamata Convention (p. 123)
Republic of South Sudan (2018-2027)	• Mentioned that GEF serves as a financial mechanism for the Minamata Convention (p. 123)
Myanmar 2015-2020	• Is mentioned that known pollution impacts on ecosystem function and biodiversity relate primarily to the contamination and eutrophication of sensitive aquatic ecosystems and include: threats to the Irrawaddy dolphin resulting from bioaccumulation of mercury released by extensive gold panning and mining in the upper reaches of the Ayeyawady and Chindwin Rivers (p. 62) • Is mentioned that large quantities of artisanal and small-scale gold mining operations have been observed in Kachin, Shan, Kayah and Kayin States and Sagaing, Bago, Mandalay and Tanithayi Regions. Informal artisanal and smallscale gold mining operations should be formalized and properly regulated, and the supply of • Mercury into the country should be restricted. Outreach and education programmes on the dangers of mercury poisoning and methods for reducing and eliminating mercury in gold mining operations should be held with artisanal gold miners around the country (p. 62)

	Mercury references in the NBSAPs
	• A specific target 8.4 has been outlined stating that "By 2020, informal and artisanal minors have an enhanced understanding of pollution and toxicity of mercury and methods to reduce its use" that has been accompanied with an activity to "Establish education and outreach programme for informal and artisanal minors on mercury and other pollutants in at least three priority states/regions" (p. 66)
Sweden 2006	• Is mentioned that mercury levels are chiefly of concern from the viewpoint of human health, but are also relevant to biodiversity, since top consumers, such as birds of prey and otters (Lutra lutra), feed on fish and may be harmed as a result. • Sweden has a target of reducing mercury emissions by 70% during 1985-1995, as it is especially harmful to higher aquatic fauna. Mentions that concentrations of toxic substances in water, sediment and biota should not exceed levels which have been demonstrated to pose no threat to aquatic species and should not prevent the normal uses of the water body, such as mercury levels in pike (Esox lucius) should not exceed 0.5 mg/kg wet weight
UK 1994	• Mentions that Research project started in 1993 on consumption and use patterns of mercury in the UK (p. 158)
Rwanda 2016	• Mentions that the mining sector is using chemicals that pollute the environment. For example, gold miners use cyanide and mercury oxide to extract the metal from earth tailings (p. 23)
Liberia 2017-2025	• Mentions that threats to Liberia's inland wetlands include but are not limited to poisoning of water bodies to kill fish, gold and diamond mining (some gold miners reportedly use mercury (p. 33)
Colombia	• Mercury is discussed in context of drives to biodiversity loss. In 2008 the use of mercury was estimated to be around 178 tonnes. A problem is the lack of tools to discourage the use of mercury in gold mining or to promote the grouping together of small miners who exploit subterranean or alluvial deposits (p. 69)
Azerbaijan 2000	• Mentions that no technologies are used to treat hazardous waste, including 0.8 tonnes of used mercury lamps (p. 19)
Kyrgyz Republic 1998	• Mentions that mining activities have caused direct damage to 3,700 ha, including soil and reservoirs that have been polluted with heavy metals, including mercury, antimony, zinc and lead
Myanmar 2011	• Habitat degradation and loss is caused by Large-scale mines generate environmental waste and release toxins into the environment while extensive gold panning is releasing mercury into the upper reaches of the Ayeyawady and Chindwin Rivers (p. 54)
Kazakhstan 1999	• A project has been carried out to purify the bottom sediments of the river Nurya from mercury compounds
Russia 2014	• Main substances that pollute underground water bodies include, inter alia, heavy metals (copper, zinc, lead, cadmium, cobalt, nickel, mercury or antimony in 479 cases) (p. 159)
Ukraine 2010-2020	• The need to update legislation for better treatment of waste is highlighted, including mercury (p. 13)
Pakistan 1999	• Most coastal pollution is concentrated in Karachi Harbour where extremely high levels of toxic heavy metals such as mercury have been documented that have both acute and • chronic toxic impacts on human beings, marine biodiversity, and fish-eating birds (p. 19)
Guyana 2007-2011	• Threats to inland water resources and biodiversity therein includes mining that releases mercury and chemicals to • the water bodies (p. 63)
Italy 2011-2020	• Section on energy mentions that combustion plants emit heavy metals in the air, such as mercury, with potentially toxic effects on organisms (p. 90)
Denmark 2004-2009	• Mentions that contamination caused by mercury has reduced (p. 15)
Estonia 1999	• Mentions that engineering, electronics and metal industries may pollute the environment with substances, including mercury (p. 117)

Annex 3. Summary of relevance of national reports of the Minamata Convention to biodiversity

Table D. Summary of sections of first full national reports to the Minamata Convention that addresses components of biodiversity.

Reporting question	Description of biodiversity-relevant activities
Art. 7.1. Have steps been taken to reduce, and where feasible eliminate, the use of mercury and mercury compounds in, and the emissions and releases to the environment of mercury from, artisanal and small-scale gold mining and processing subject to Art. 7 within your territory?	• While the importance of the ASGM sector is noted the government remains committed to ensuring that mining is done in a safe, responsible and sustainable manner that supports our international commitments and aligns with national policies and strategies. This includes using an ecosystems approach to sustainably growing the extractive and forestry sector, including supporting sustainable mining through improved planning and recovery in mining areas. (Guyana)
Art. 12.1. Has the party endeavored to develop strategies for identifying and assessing sites contaminated by mercury or mercury compounds in its territory	• An inspection carried out in 2007-2008 revealed that about 200.000 tons of tailings in 120 sites in the territory of 10 provinces, covering 53 hectares of area and dozens of groundwater wells were contaminated by mercury and cyanide. To mitigate and neutralize the contamination, 197.687 tons of slime accumulated in 230 sites of 37 soums of 9 provinces were transported to 6 sites for designated landfilling, 128.444 m2 of soil contaminated by chemicals were neutralized between 2008 and 2009. (Mongolia) • Within the framework of the NAP Project, a study linked to mercury levels in sediments from water resources and tailings (pulp) from gold mills in the Paso Yobái district was conducted. (Paraguay)
Art. 14.2. Has the party received capacity-building or technical assistance pursuant to Art. 14?	• Entry into analysis of mercury in species in different abiotic matrices (2018), carried out in Ljubljana, Slovenia at the Jozef Stefan reference laboratory. (Ecuador)
Art. 17.1. Has the party facilitated the exchange of information referred to in Art. 17.1?	• "In 2016, Canada published its first comprehensive, national synthesis and evaluation of scientific mercury research, the Canadian Mercury Science Assessment (CMSA). This Assessment summarizes national research and monitoring activities within the past 20 years, providing an in-depth look at biotic, abiotic and human biomonitoring data. The CMSA concluded that mercury remains a risk to Canadian ecosystems and the report identified areas in Canada that have the highest risk to mercury exposure." (Canada) • The exchange of information is being facilitating through the implementation of the GOS4M Knowledge Hub. The GOS4M-KH provides access to datasets and a tool to retrieve information on fate of mercury emissions, from sources to receptors, and in the future estimate of costs associated with policies. This platform includes an emulator for analyses of complex chemo-physical atmospheric model outputs, coupled with a bio-geochemical model to simulate processes in the ocean and trophic model to estimate mercury uptake by biota. The first level macro-indicator is the Hg bioaccumulation in biological endpoints, which can be Hg in fish at upper trophic level, the second level is the Hg concentration in ambient air and precipitation samples. Long- term trends of macro-indicators can be analysed to assess the effectiveness of measures on medium-long term time period and eventually estimate associated socio-economic costs. (Italy)
Art. 18.1. Have measures been taken to promote and facilitate the provision to the public of	• In 2020 and 2021, online webinars were held on the effects of mercury on aquatic ecosystems and marine mammals. (Chile)

Reporting question	Description of biodiversity-relevant activities
the kinds of information listed in Art. 18.1?	
Art. 19.1. Has the party undertaken any research, development and monitoring in accordance with Art. 19.1?	• "The ECCC atmospheric model was coupled to terrestrial, aquatic and bioaccumulation models, and impacts of mercury emission reductions on future fish mercury concentrations in five ecosystems across Canada were demonstrated." (Canada) • Monitoring projects include the tracking of mercury in water, sediment and invertebrates, and projects to assess the role of aerial deposition on the long-distance transport and environmental fate of mercury. Data will be used to track the effectiveness of remedial measures and regulatory decisions. (Canada) • The Whales Initiative Science and Contaminants Monitoring is conducting scientific research and monitoring of contaminants of concern, including mercury, in different media (i.e. air, freshwater, sediment, landfill leachate, wastewater influent, effluent, and biosolids, and biota) that are affecting Southern Resident Killer Whales and St. Lawrence Estuary Belugas as well as their prey. (Canada) • The Northern Contaminants Program (NCP) led by Crown-Indigenous Relations and Northern Affairs Canada engages Northerners and scientists in the research and monitoring of long-range contaminants in Northern Canada, including mercury. The core monitoring program of the NCP includes long-term temporal trend assessments of contaminants in the air and water as well as key/sentinel fish and terrestrial and marine wildlife species that are harvested as traditional food sources by Northern Indigenous Peoples. For example, contaminants in the tissues of polar bears, ringed seals, beluga, caribou, seabird eggs, lake fish (Arctic char, trout, burbot) and sea-run Arctic char are routinely monitored. (Canada) • The Great Lakes Herring Gull Contaminant Monitoring Program, as well as related programs in the Atlantic, St. Lawrence, and Pacific has provided long term data concerning levels of environmental contaminants in colonial waterbird eggs, including mercury. (Canada) • The Oil Sands Monitoring program tracks mercury levels in air, water, sediment, invertebrates, fish and wildlife, related to oil sands development. (Canada) • Evaluation of mercury concentration levels in components of ichthyofauna and aquatic macroinvertebrates in the mining area of the province of El Oro (Ecuador) • Research activities related to monitoring of levels of mercury in environmental media were focused mainly on apex predatory mammals. (Croatia) • Mercury levels in the muscle tissue of 12 commercially important fish species from 48 locations in the eastern Adriatic Sea were analyzed, as a function of fish species. (Croatia) • Levels of mercury in Finnish fish were studied in a research project "EU-kalat III" by several Finnish institutions in 2016-2018. (Finland) • Finnish data to the AMAP assessment of mercury in the Arctic was produced in a project "Environmental and human exposure to mercury in the Arctic" by several Finnish institutions in 2019-2021. The project investigated long-term changes in the mercury load, accumulation in biota and human food, the amount of human exposure in Lapland and the differences in exposure across the country. (Finland) • Concerning the monitoring of mercury in the marine environment, it is in particular within the framework of the Observation Network for Chemical Contamination of the Coastline (ROCCH), operating in connection with the European Strategy Framework Directive for the Marine Environment (DCSMM), actions are taken. Mercury is among the elements that can be detected in mussels and oysters, fish, marine mammals, and since 2019 birds are also included in the samples that are tested. In mainland France, surveillance covers all marine areas (the Channel, the Atlantic coast and the Mediterranean). (France) • The Multistress research program on gulls in metropolitan France (New Acquitaine), by measuring the presence of mercury and POPs from blood samples. The first results surprisingly show very high mercury contamination, particularly in sea gulls, whose levels sometimes exceed those observed in polar areas and in French Guiana. (France) • The SENTINEL project aims to establish the inventory of contaminants (mercury, POPs, poly- and perfluorinated compounds) present in seabirds in French Guiana, to interpret the levels observed via trophic ecology and to estimate the effects on physiology, immunity and reproduction. These toxicological data are essential to monitor, via these sentinels, the overall state of health of the Guyanese coast. (France)

Reporting question	Description of biodiversity-relevant activities
	• The ANR CONTAMPUMP project aims to understand the biological mechanisms of metallic and organic chemical contamination at the base of marine food webs in pelagic and benthic plankton and planktonophages, and mercury and methylmercury were among the substances that were measured there. Monthly CONTAMPUMP sampling resumed in June 2020 and will continue until November 2021 in the bay of Marseille: (France) • The objective of the MERTOX project (2018-2021) is to complete the limited knowledge on the accumulation of marine MeHg in pelagic fish. The researchers have just published the first high-resolution mapping of the spatial distribution of Hg concentrations for 3 tuna species across the South West Pacific. They also developed a statistical model to characterize the spatial distribution of Hg concentrations for 2 tuna species. They succeeded in estimating the Hg isotopic composition of seawater (Mediterranean) thanks to the analytical method developed within the framework of the project for the first time in the world. (France) • The data base for maritime environment (MUDAB) collected data of different compartments by using 42.813 measuring stations in North and Baltic Sea. Data for mercury and methylmercury were collected for biota (1990-2020), water (1986-2021), and sediment (19984-2020). (Germany) • Terrestrial mercury monitoring by means of moss as a bioindicator of atmospheric pollution of the air by mercury. (Germany) • Annual monitoring of mercury and methylmercury in fish, shellfish, crustaceans and seaweed is carried out as part of the Irish National Chemical Sampling Programme (NCSP) in fulfilment of official controls concerning maximum levels established in Commission Regulation (EC) 1881/2006 as amended. From 2017-2021 (Ireland) • Modelling and geographically representative monitoring of levels of mercury and mercury compounds in vulnerable populations and in environmental media, including biotic media such as fish, marine mammals, sea turtles and birds, as well as collaboration in the collection and exchange of relevant and appropriate samples; (Ireland) • The Netherlands has, in accordance with EU law and international conventions (e.g. OSPAR and international river basin commissions such as the International Commission for the Protection of the Rhine), monitoring programmes in place for relevant polluting substances, a.o. mercury, in surface water and surface water sediment and biota. (Netherlands) • The Norwegian Environment Agency monitors hazardous chemicals including mercury in air and precipitation, lakes, fjords, marine areas and in terrestrial environment. Monitoring is mainly conducted in organisms such as cod, blue mussels, trout, seabirds, zooplankton, shrimps, bird of prey, earthworms and foxes. (Norway) • A study has been conducted on the phytoremediation of cadmium and mercury with water hyacinth (Peru) • The Seychelles Fishing Authority in collaboration with the Department of Health has carried out research to study the levels of mercury levels in different fish species and the effect on Health (child development). (Seychelles) • Environmental monitoring of mercury includes, inter alia, detection of metals in moss, in marine biota and fresh water fish (Sweden) • Modelling and geographically representative monitoring of levels of mercury and mercury compounds in vulnerable populations and in environmental media, including biotic media such as fish, marine mammals, sea turtles and birds was undertaken during the national Minamata Initial Assessments study. (Uganda) • The Dragonfly Mercury Project (DMP) is a national-scale citizen science study that utilizes a high quality, centralized laboratory to examine variation in Hg concentrations in dragonfly larvae across more than 400 sites in 111 National Park Service units throughout the continental United States and Alaska (United States)

Annex 4. Links to biodiversity in National Action Plans on artisanal and small-scale gold mining under the Minamata Convention

Table E. Description of impacts of ASGM on biodiversity and national activities taken to mitigate those impacts (as described in the National Action Plans).

Country	Biodiversity mentions	Description of biodiversity impacts of ASGM and mining activities using mercury	National goals, objectives, targets and activities related to biodiversity
Burkina Faso (2020)	0	N/A	N/A
Burundi (2021) (French)	21	• Gold mining contributes to deforestation, soil degradation, air and water pollution from waste oils, engines and chemical products (used batteries abandoned), loss of biodiversity, deterioration of the landscape, etc. (p. 4) • Cyanide is released into the environment, in particular in springs and watercourses, despite efforts to control it, leading to loss of biodiversity in soil and crops and even flora and fauna. (p. 11) • ASGM destroys watercourses and their biodiversity through the relocation of riverbeds, the destruction of banks and fish farming with its ecotone, sedimentation of watercourses, destruction (by accumulating residues) of cultivated wetlands, etc. (p. 11) • Impacts of ASGM on biodiversity include the destruction of the soil and severe drying out of marshes, leading to death of various species of soil microfauna and microflora. (p. 11) • Mining has caused wildlife decline, because it is located on slopes of hills, edges of watercourses, foothills, which are biodiversity rich areas (p. 11)	• The NAP highlights that need to remediate areas contaminated by mining to minimize impacts on biodiversity. The NAP includes a target to by 2023 to prepare studies on the rehabilitation of biodiversity and the environment: a) Conduct a study on the chemical contamination of water, air, soil, plants and animals, b) raise awareness among target groups of biodiversity loss due continued mining, c) conduct a study on the protection of fish species and their preservation in the basins slopes affected by ASGM (p. 22)
Central African Republic (2019) (French)	2	• The mining sector is a major contributor to deforestation, land degradation, and generation of waste. Deforestation is caused by artisanal miners who remove trees on the sites to allow them access to the gravel and construction of makeshift habitats that leads to erosion and biodiversity loss. Mining leads to surface water pollution that has a negative impact on aquatic species and the drying up of rivers (p. 9) • The river that runs alongside the mining site is used for ore processing that leads to a decline in water quality due to high turbidity and has a huge impact on aquatic biodiversity, in particular benthic species (p. 22).	N/A

Country	Biodiversity mentions	Description of biodiversity impacts of ASGM and mining activities using mercury	National goals, objectives, targets and activities related to biodiversity
Chad (2022) (French)	6	• Artisanal mining contributes to deforestation, soil degradation, air pollution, degradation of soil and water by used engine oils, loss of biodiversity, deterioration of the landscape are other environmental problems	N/A
Republic of Congo (2021) (French)	11	• Artisanal mining takes place in approximately 40% of protected areas and continues to expand, which has direct and indirect impacts on forest ecosystems and can cause loss of wildlife and biodiversity in mining areas. Diggers use some forest species to protect their wells in extraction underground, to dam the rivers in alluvial extraction on river and to build their hangar for the processing of the ores obtained by these two channels. Also, the presence of a large population of diggers, their families and other actors, creates a demand for wood for cooking food and semi-durable constructions adapted to the migratory nature of the mining sector. (p. 29) • Gold mining in rivers, and especially using dredges, has significant impacts on the quality of river water. The river Kibali is heavily polluted by the presence of suction dredgers (these use mercury, fuel, and various machine maintenance products, but also noise pollution and disturbance of the bottom sediments of the river). In addition, water contamination is caused by poor management of discharges/residues from ore, which may contain toxic chemicals. Thus, certain rivers in South Kivu, where the local populations once fished, only harbors most resistant fish species. Materials from mining operations, such as waste and contaminated soils, can load sediments with chemical pollutants. (p. 29) • Identified problems include mining in protected areas that leads to biodiversity loss, particularly affecting endangered species (p. 34)	N/A
Ecuador (2020)	2	• Deforestation and vegetation grubbing are consequences of the expansion of mining. This has led to negative impacts on local ecosystems that suffer loss of biodiversity, migration and loss of species, landslides, and eutrophication of waters, among other consequences (p. 48).	• Biodiversity aspects are not reflected in the targets and activities.
Eswatini (2021)	I	• Reduction in biodiversity is widespread. Alluvial panning is carried out in riverine areas hosting protected plant species such as Phoenix reclinate and Cythea dregii. (p. 15) • A transboundary network of ASGM activity has created vast tracks of roadways inside the Malolotja Nature Reserve, which is used to access the mines from the South African side. Reduced numbers of fauna are reported. (p. 15)	N/A
Ghana (2020)	0	N/A	• A customised satellite-based remote sensing service known as GalamWATCH has been implemented to map and monitor artisanal and small- scale mining (ASM) activities as well as abnormal land cover

Country	Biodiversity mentions	Description of biodiversity impacts of ASGM and mining activities using mercury	National goals, objectives, targets and activities related to biodiversity
			change(s) such as that associated with deforestation. (p. 1)
Guyana (2021)	6	• Gold mining is the principal driver of deforestation in Guyana. A visual review of satellite imagery for the mining sites revealed a significant change in forest cover clearance. This impacts local ecosystems through biodiversity loss, habitat loss, migration of species, among other consequences. (p. 58) • According to Guyana's fourth national report to the CBD, inadequate tailings management, little to no rehabilitation of mined out areas, and increased hunting of wildlife typically associated with gold mining in Guyana pose increasing threats to biodiversity. • Sedimentation from the discharge of tailings from land and river dredges also lead to increased turbidity and impact fish habitats and other aquatic life. Results from a study found that the diversity of fishes in the Konawaruk River was impacted due to sedimentation and habitat destruction. (p. 59)	• An intervention area is included to strengthen environmental management in SMS gold mining sector through Strategic Environmental Assessment and development of Environmental Management Strategy for SMS gold mining. Assessment of environmental impacts in mining districts is intended to inform development of policies regarding allocation, opening and closing of mining areas to minimize water quality concerns and deforestation
Guinea (2021)	0	N/A (search tool did not function propertly)	N/A
Indonesia (2022)	3	• Alluvial mining has a major negative impact on rivers due to accelerated erosion, and suspended sediments which reduce light penetration and oxygen availability in aquatic ecosystems (p. 55) • Landscape-level impacts are also severe, with widespread deforestation resulting from ASGM (p. 55) • ASGM has negative impacts on soil fertility due to the loss of topsoil from formerly productive agricultural or forested land. Inventory data from contaminated sites shows that cyanide and mercury from ASGM and cinnabar mining has contaminated vast areas. (p. 55)	N/A
Kenya (2022)	0	N/A	N/A
Kyrgyzstan (2022)	0	N/A	N/A
Lao People's Democratic Republic	2	• In Bolikhamxai Province, ASGM activities were previously practiced and might still take place within the Nakai-Nam Theun National Biodiversity Conservation Area (NBCA). (p. 23)	N/A
Madagascar (2019)	0	N/A	• By 2021, pollution tests on waterways most contaminated by chemicals are carried out by the Ministry of the Environment

Country	Biodiversity mentions	Description of biodiversity impacts of ASGM and mining activities using mercury	National goals, objectives, targets and activities related to biodiversity
			• By 2020, a vast program of reforestation is developed, implemented in **50% of abandoned artisanal mining areas,** including providing training in agroforestry • By 2021, artisanal gold miners are trained on the management of waste and water resources on the mining sites in 15 municipalities • By 2023, funds are allocated for the rehabilitation of abandoned sites in 15 municipalities
Mali (2020)	0	• The environmental risks identified at mining sites are largely related to the use of products chemicals, such as mercury and cyanide, which affect fauna, flora, water resources, soil and air. • Other environmental problems caused by ASBM in Mali include deforestation caused by clearing of vegetated areas and erosion; habitat loss and soil degradation; water pollution by sediments; the drying up of watercourses by dredging in the Niger and Falémé rivers; alteration of groundwater by excessive pumping; the proximity of certain forests and reserves, or migration routes of protected species. • Among the other significant phenomena that pollute the environment in gold panning sites is the release into nature of used batteries that contain lead, but also of plastic bags	N/A
Mongolia (2020)	3	• ASGM operations pose the following negative impacts on the biological diversity: Creation of multiple dirt roads, pits and canals, temporary settlement zones degrade the living environment for wildlife; Increased risk for human and wildlife to fall in the vertical shafts and pits; Loss of river flows and diversion due to mining operations on the placer gold mine along river basins that results in loss of biodiversity due to river pollution and degradation of wildlife living environment; Excessive poaching of wildlife by artisanal miners; Contamination of surface, soil and aquatic environment resulting from uncontrolled disposal of mercury contaminated slimes and ores, poisoning wildlife through food chain; Artisanal mining operation takes place inside or near specially protected areas affecting vulnerable animals (p. 31)	• Objective 1 "To halve mercury emissions and releases and environmental pollution caused by ASGM" includes a strategy "to monitor and prevent mercury pollution, emissions and releases caused by artisanal and small-scale mining and processing, carry out research on risks and exposures to mercury and reduce mercury contaminated and eroded areas through remediation and neutralization" (p. 42) • Frugal Rehabilitation Guidelines have been developed and approved as an Annex to Regulation for Extraction of Minerals by Artisanal Mining. By the end of 2017, artisanal miners rehabilitated in total 317.1 Hectares. (p. 31)
Nigeria (2021)	1	• Deforestation is a serious problem resulting from artisanal gold mining, due to sudden influx of people over an area whenever gold is discovered. Usually, ASGM activities commence after massive clearing of existing vegetation (p. 112) • Abandoned pits remain unmapped, unaccounted for and unsafe and have adverse impacts on ecosystems and humans. There is usually no plan for	• Objective to reduce ASGM-associated environmental hazards including mercury emissions/pollution, land degradation and ecosystem contamination. (p. 125) • Strategies to promote the reduction of emissions, releases, and risks of exposure to mercury including

Country	Biodiversity mentions	Description of biodiversity impacts of ASGM and mining activities using mercury	National goals, objectives, targets and activities related to biodiversity
		reclamation and restoration of mined-out areas. Most farmlands were littered with both active and abandoned pits, thereby making the farmlands unsuitable for farming purposes. (p. 112) • Due to large dependence on water by the artisanal gold miners for washing of ore, most processing activities are done at flood plains and beside streams. The tailings in ASGM are released directly into the environment that has led to massive river siltation and mercury contamination. The use of cyanide has led to deaths of fishes and other aquatic lives. (p. 113-115)	management of contaminated sites include, inter alia, the development of National guidelines for management of contaminated sites and pilot remediation of selected sites (p. 136)
Paraguay (2020) (Spanish)	0	N/A	N/A
Senegal (2019) (French)	2	• Environmental challenges caused by ASGM in Senegal include: pollution through the use of other chemicals (e.g. cyanide); deforestation caused by clearing of vegetated areas and erosion; habitat loss and soil degradation; water pollution by sediments and other chemicals; the drying up of watercourses by dredging at river level; and alteration of groundwater due to excessive pumping (p. 24). • The water sediments at the main gold mining sites in Senegal have higher mercury levels than the maximum thresholds recommended for fresh water. Analysis of the mercury content of mollusks showed all cases had mercury levels above WHO standard. (p. 24)	• Good management of the environment and biodiversity is a key principle that has guided the development of the NAP (p. 29) • The working group established for the development of the NAP is to undertake research on other ongoing initiatives in related sectors (such as public health, trade, global chemicals and watershed management, biodiversity conservation) that could be linked to the activities foreseen in the NAP (p. 71)
Sierra Leone (2020)	8	• Land is degraded by all forms of ASGM activity as mining pits are routinely left behind after the mining activities end, without any form of rehabilitation. With the use of satellite images, it has been estimated that land degradation resulting from ASGM activity is advancing with a minimum annual speed of 500 hectares. (p. 38) • The preparation of ASGM mine sites requires the removal of plants and trees, which are typically not replanted after the mining ends and which are less likely to grow again due to the removal of layers of fertile soil. This contributes to deforestation and may, depending on the location, also cause loss of biodiversity. ASGM activity has been reported to take place in Sierra Leone's national protected areas, such as the Gola Rainforest. (p. 38) • ASGM activity leads to the contamination of water resources, particularly streams and rivers due to runoff of mining waste from tailings which are poorly managed, if at all. For example, in Baomahun, mining waste and tailings including mercury, is washed down to the valley during excessive rains in the wet season. Even where no chemicals are used water quality is affected; the sediments that are released to the water increase turbidity, thus reducing the amount of light	• To design guidelines for land rehabilitation, mine closure and tailings management that are easy to understand, available in local languages and specific to the AM sector, and to disseminate these guidelines among each of Sierra Leone's 25 identified AGM areas and respective chiefdom authorities by December 2022 (p. 44) • To design guidelines for land rehabilitation, mine closure and tailings management that are easy to understand, available in local languages and specific to the SSM sector, and to disseminate these guidelines among each SSM company operating in Sierra Leone by December 2022 (p. 44) • Design a strategy for rehabilitating identified mercury-contaminated sites by December 2021 and pilot it in one ASGM community by December 2022

Country	Biodiversity mentions	Description of biodiversity impacts of ASGM and mining activities using mercury	National goals, objectives, targets and activities related to biodiversity
		available to the river habitats. This is likely to adversely affect aquatic life and biological diversity in river ecosystems (p. 38) • Water contamination results from all forms of ASGM but is particularly caused by dredges used in small-scale gold mining operations (Sierra Leone). (p. 38) • Lack of mine closure and land rehabilitation, leading to deforestation, biodiversity loss, increased spread of malaria, decreased land suitable for agriculture, and soil erosion. (p. 44)	
Uganda (2021)	17	• Deforestation is wide-spread (p. 51) • Restoration of abandoned mining sites is insufficient (p. 50) • Some mining operations take place in wetlands, forest reserves and protected areas. Exploration licenses have been issued to companies within protected areas without consent from environmental authorities. There is limited to no monitoring of ASGM sites within protected areas given that they illegally mine there hence resulting in severe damage to the ecosystem. (p. 52) • Mining involving use of hazardous chemicals such as mercury and cyanide has caused water and soil contamination. (p. 54)	• NAP implementation teams and responsible MDAs are also encouraged to ensure that special attention is given to biodiversity sensitive and protected areas (p. 70). • A specific intervention has been dedicated for **Strengthening the conservation of protected areas**, which include the following activities (p. 90-91): 1. Strengthening the capacity of environment protection police force and minerals police unit to carry out their mandate 2. Holding public hearings before allocating mining leases on extensive pieces of land including protected areas 3. Holding stakeholder engagements to agree on sustainable co-existence of ASGM activities with biodiversity in protected areas 4. Inspecting and monitoring ASGM activities in protected areas 5. Updating geological maps with protected areas' layers to indicate where the protected areas are situated so as to prevent licensing of these areas without prior stakeholder consultations 6. Assessing the impact of upstream and downstream ASGM activities (wetlands, water bodies)

Country	Biodiversity mentions	Description of biodiversity impacts of ASGM and mining activities using mercury	National goals, objectives, targets and activities related to biodiversity
Tanzania (2022)	1	• ASGM activities are estimated to contribute to land degradation and deforestation at a rate of about 7.440-18.600 hectares per annum. (p. 14) • Back-filling of ASGM pits is rarely undertaken, thus contributing to land degradation. (p. 14)	• The National Task Force has been tasked to undertake a baseline situation analysis of ASGM activities in Tanzania. Relevant activities include: 1) assessment of nature and extent of environmental impacts associated with ASGM activities, including assess the nature, rate and extent of loss of biodiversity associated with ASGM activities, and 2) Provide driving factors and indicative annual land degradation, deforestation and loss of arable farming land by ASGM. (p. 57)
Zambia (2021)	5	• ASGM activities has resulted in destruction and modification of the original landscape causing loss of biodiversity and affecting the overall functions of ecosystems. (p. 15) • ASGM activities near protected areas has negatively impacted wildlife populations due to migration and poaching (p. 15) • All alluvial gold mining activities were observed to be located in the perennial streams and riverbeds which would lead to siltation of streams and rivers (p. 15) • ASGM activities have resulted in land degradation, abandoned pits, siltation and sedimentation of streams (p. 16) • Abandoned pits have became traps for domestic and wild animals and breeding grounds for mosquitoes (p. 16) • The major impacts on surface and groundwater include among others water pollution (discharge of effluent with high concentration of mercury, other heavy metals, and silt), destruction of aquatic life, disruption of the natural flow regime.	• The implementation strategy includes a target to prohibit any mercury or cyanide-based gold processing techniques within 100 m of a natural water body. This is accompanied with an activity to continue monitoring contamination levels in rivers and other environmental sinks close to mercury processing sites (p. 44)
Zimbabwe (2019)	1	• Studies show that in certain areas ASGM activities could lead to the extinction of plant and animal species, resulting in the disruption of the ecosystem and causing an imbalance in beneficial macro- and microorganisms. In addition, the loss of habitat (drying up of rivers and surface waters; degraded land) has negatively affected aquatic life, terrestrial biodiversity and productivity of both livestock and crops in the district. (p. 32) • Mercury is dumped in the environment with no proper disposal systems, creating risks of contamination of soil, water and air and human and animal exposure risks. Mercury rich tailings are also disposed of on tailings dams that are not lined (p. 38)	• Technologies and procedures for storage of mercury and disposal of waste containing mercury identified and tested with miners by 2021; At least 50% of the miners adopt technologies by 2022 (p. 28)

Table F. Compilation/classification of the impacts of ASGM activities on biodiversity (as described in NAPs).

Biodiversity impacts	Description of impacts
Deforestation caused by clearing of vegetated areas and erosion	• Deforestation is caused by artisanal miners who remove trees on the sites to allow them access to the gravel and construction of makeshift habitats that leads to erosion and biodiversity loss. (Central African Republic) • Gold mining is the principal driver of deforestation in Guyana. A visual review of satellite imagery for the mining sites revealed a significant change in forest cover clearance (Guyana) • Landscape-level impacts are also severe, with widespread deforestation resulting from ASGM (Indonesia) • Environmental problems caused by ASM gold include deforestation caused by clearing of vegetated areas and erosion (Mali) • Deforestation is a serious problem resulting from artisanal gold mining, due to sudden influx of people over an area whenever gold is discovered. Usually, ASGM activities commence after massive clearing of existing vegetation (Nigeria) • The preparation of ASGM mine sites requires the removal of plants and trees, which are typically not replanted after the mining ends and which are less likely to grow again due to the removal of layers of fertile soil. This contributes to deforestation and may, depending on the location, also cause loss of biodiversity (Sierra Leone)
Deterioration of water courses and aquatic life	• ASGM destroys watercourses and their biodiversity through the relocation of riverbeds, the destruction of banks and fish farming with its ecotone, sedimentation of watercourses, destruction (by accumulating residues) of cultivated wetlands (Burundi) • Mining leads to surface water pollution that has a negative impact on aquatic species and the drying up of rivers (Central African Republic) • River that runs alongside the mining site is used for ore processing that leads to a decline in water quality due to high turbidity and has a huge impact on aquatic biodiversity, in particular benthic species (Central African Republic) • Sedimentation from the discharge of tailings from land and river dredges also lead to increased turbidity and impact fish habitats and other aquatic life (Guyana) • Alluvial mining has a major negative impact on rivers due to accelerated erosion, and suspended sediments which reduce light penetration and oxygen availability in aquatic ecosystems (Indonesia) • ASGM causes loss of river flows and diversion due to mining operations on the placer gold mine along river basins that results in loss of biodiversity due to river pollution and degradation of wildlife living environment (Mongolia) • The tailings in ASGM are released directly into the environment that has led to massive river siltation and mercury contamination. The use of cyanide has led to deaths of fishes and other aquatic lives (Nigeria) • Water sediments at the main gold mining sites in Senegal have higher mercury levels than the maximum thresholds recommended for fresh water (Senegal) • ASGM activity leads to the contamination of water resources, particularly streams and rivers due to runoff of mining waste from tailings which are poorly managed, if at all. For example, in Baomahun, mining waste and tailings including mercury, is washed down to the valley during excessive rains in the wet season. (Sierra Leone) • Water contamination results from all forms of ASGM, but is particularly caused by dredges used in small-scale gold mining operations (Sierra Leone) • Mining involving use of hazardous chemicals such as mercury and cyanide has caused water contamination (Uganda) • ASGM activities are estimated to contribute to land degradation and deforestation at a rate of about 7,440 - 18,600 hectares per annum (Tanzania)
Land degradation	• The destruction of soil includes the death of various species of soil microfauna and microflora (Burundi) • ASGM has negative impacts on soil fertility due to the loss of topsoil from formerly productive agricultural or forested land (Indonesia) • Abandoned pits remain unmapped, unaccounted for and unsafe and have adverse impacts on ecosystems and humans. Most farmlands were littered with both active and abandoned pits, thereby making the farmlands unsuitable for farming purposes. (Nigeria)

Biodiversity impacts	Description of impacts
	• Land is degraded by all forms of ASGM activity as mining pits are routinely left behind after the mining activities end, without any form of rehabilitation (Sierra Leone) • Mining involving use of hazardous chemicals such as mercury and cyanide has caused soil contamination (Uganda) • Back-filling of ASGM pits is rarely undertaken, thus contributing to land degradation. (Tanzania)
The drying up of watercourses , including marshes and rivers	• Drying up of watercourses by dredging in the Niger and Falémé rivers (Mali) • Drying up of watercourses by dredging at river level (Senegal) • Soil erosion has caused the shrinking of swamps through siltation (Sierra Leone)
Wildlife decline	• Mining has caused wildlife decline, because it is located on slopes of hills, edges of watercourses, foothills, which are biodiversity rich areas (Burundi) • Increased hunting of wildlife typically associated with gold mining (Guyana) • Migration routes of protected species are affected (Mali) • Excessive poaching of wildlife by artisanal miners (Mongolia) • ASGM causes contamination of surface, soil and aquatic environment resulting from uncontrolled disposal of mercury contaminated slimes and ores, poisoning wildlife through food chain (Mongolia) • ASGM leads to creation of multiple dirt roads, pits and canals, temporary settlement zones degrade the living environment for wildlife; • Abandoned pits have became traps for domestic and wild animals and breeding grounds for mosquitoes (Zambia)
Threats to conservation efforts	• Artisanal mining takes place in approximately 40% of protected areas and continues to expand (Republic of Congo) • ASGM activity has created vast tracks of roadways inside the Malolotja Nature Reserve, which is used to access the mines, which has led to a reduced number of fauna (Eswatini) • Artisanal mining operation takes place inside or near specially protected areas affecting vulnerable animals (Mongolia) • ASGM activity has been reported to take place in Sierra Leone's national protected areas, such as the Gola Rainforest (Sierra Leone) • Some mining operations take place in wetlands, forest reserves and protected areas. (Uganda) • ASGM activities near protected areas has negatively impacted wildlife populations due to migration and poaching (Zambia)