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THE PRECAUTIONARY PRINCIPLE AND DEEP-SEABED MINING:

A State obligation under international law that must be urgently respected

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POLICY BRIEF
UPDATED VERSION



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This Policy Brief aims to inform ongoing deliberations at the International Seabed Authority (ISA) on deep-seabed mining (DSM) to clarify the legal and scientific bases for the urgent application of the precautionary principle and the main measures States must take in accordance with their obligations under international law, and international human rights and environmental law. In the face of the triple planetary crises of climate change, biodiversity loss, and pollution,[1] avoiding the risks of DSM is both urgent and necessary.

This brief outlines: (A) the status of DSM contracting; (B) the environmental and human rights risks posed by DSM, and (C) the international obligations of States to protect the marine environment, and to respect, protect and fulfil human rights. The brief has been updated in light of the International Court of Justice Advisory Opinion on climate change (July 2025) as it is directly relevant to DSM and States' obligations.

It concludes States must urgently decide to implement a precautionary pause on DSM activities, at the ISA, to prevent irreversible harm to the marine environment, the climate system, and the full enjoyment of human rights, including the right to a clean, healthy and sustainable environment. The precautionary principle should be applied at least until robust independent scientific assessments, the transparent and participatory discussion and adoption of robust environmental and human rights legal and institutional frameworks are in place.

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Executive Summary

- The seabed beyond national jurisdiction is the common heritage of humankind, governed by UNCLOS and administered by the ISA, which has yet to adopt exploitation regulations or environmental and human rights safeguards.

- DSM poses severe, potentially irreversible risks to marine ecosystems, biodiversity, and carbon sequestration, amid critical scientific uncertainties, including baseline ecological data, long-term ecosystem impacts, and the full extent of harm to ocean functions.

- DSM threatens the human rights to life, health, food, culture, and a clean, healthy, and sustainable environment of all on this planet, and disproportionately threatening the rights of Indigenous Peoples, small-scale fishers, and coastal communities whose survival, livelihoods, and cultural identity depend on healthy marine ecosystems.

- Given the plausible severe or irreversible risks of environmental harm and potential human rights violations associated to DSM, in the absence of scientific certainty, and based on UNCLOS and international law, States should urgently adopt a precautionary pause on DSM, enabling time for independent scientific assessments, transparent and participatory discussions and the adoption of robust environmental and human rights legal and institutional frameworks.

Status of Deep-Seabed Mining (DSM) contracting

The deep sea is the largest ecosystem on Earth, covering between 50 and 65% of its surface,[2] and it harbours most of the approximately 1 million ocean species, including an abundance of rare and unique marine life.[3] The deep sea also supports multiple ecosystems and its processes that are crucial for our planet's natural systems, and for the communities and Peoples who depend on them.[4] Further, the deep sea is the planet's largest carbon sink.[5] Parts of the deep seabed of the Pacific Ocean are covered with polymetallic nodules that might contain critical minerals. Researchers have recently discovered "dark oxygen" and are clarifying how nodules are involved in oxygen production.[6]

DSM is the process of extracting mineral deposits from the deep seabed. Polymetallic nodules, polymetallic sulphides, and cobalt-rich ferromanganese crusts are the primary targets of this kind of mining due to their high concentrations of metals like cobalt, nickel, copper and manganese.[7] These metals are used for industrial applications and energy transition technologies, including batteries and renewable technologies.

The United Nations Convention on the Law of the Sea (UNCLOS) provides that the seabed beyond national jurisdiction and its resources are "common heritage of mankind".[8] The International Seabed Authority (ISA) is the international organization responsible for organising and controlling mining activities on the seabed beyond national jurisdiction.[9] In its role, the ISA has the mandate to take measures to ensure the effective protection of the marine environment from the harmful effects of DSM activities in the seabed.[10,11] UNCLOS (Article 145) expressly states that ISA "shall adopt appropriate rules, regulations and procedures for *inter alia*: the prevention, reduction and control of pollution and other hazards to the marine environment... the protection and conservation of the natural resources of the Area and the prevention of damage to the flora and fauna of the marine environment."[12]

DSM is still under an exploratory phase. Since 2001, the ISA has issued 32 exploration contracts, of which there are 31 in force, primarily on the Clarion-Clipperton Zone (CCZ),[13] a region known for its polymetallic nodules, and for its high biodiversity and ecological fragility.[14] The ISA has yet to adopt a comprehensive framework for the exploitation of deep-seabed minerals. The exploration and exploitation regulations must strongly be clear that international human rights law applies to DSM, including through the creation of mechanisms that facilitate public participation in decision-making of those most impacted by DSM,[15] and robust environmental and human rights impact assessments.[16] In addition, the ISA has not yet adopted any general environmental policy.[17]

Moreover, the ISA lacks robust institutional policies relevant to the protection of human rights, such as: a stakeholder engagement policy; whistle-blowing procedures; formal procedures for the participation of Indigenous Peoples, small-scale fishers and coastal communities in decision-making; specific guarantees for transparency and provision of independent scientific advice, as well as processes to identify and avoid conflict of interests and corporate capture;[18] and grievance or redress mechanisms for affected persons and communities.

Risks to the marine environment and human rights from deep-seabed mining

First, extensive research increasingly suggests that DSM poses unavoidable,[19] severe, often irreversible risks to marine ecosystems.[20] These risks include biodiversity loss,[21] such as abyssal epifauna[22] and endemic species of hydrothermal vents.[23] Other risks also include long-term habitat loss,[24] disruption of ecosystem services,[25] and unknown additional consequences for fragile deep-sea marine biodiversity.[26] Noise and light pollution, and waste-water returned to the ocean containing sediment and metal traces may also interact negatively with midwater animals, including fish stocks.[27]

Deep-seabed mining poses severe and irreversible risks of harm to the marine environment.

Second, DSM may negatively affect the climate by releasing stored carbon and disrupting the ocean's carbon sequestration processes.[28] DSM activities disturb sediment layers, which play a key role in carbon storage. Therefore, DSM risks releasing stored carbon and impairing the ocean's ability to act as a carbon sink.[29] The negative impacts on deep-sea biodiversity and ecosystems outlined above also impair species and ecosystems that enable carbon sequestration. For example, disruption of fish populations can impair their crucial role in sequestering and storing carbon.[30] Further, the energy-intensive nature of mining operations may contribute to a significant increase of greenhouse gas (GHG) emissions.[31]



This octopus was observed slowly making its way across the seafloor at a depth of 2,530 meters (8,300 feet) during Dive 06 of the 2023 Shakedown + EXPRESS West Coast Exploration expedition off the coast of Oregon. Image courtesy of NOAA Ocean Exploration, 2023 Shakedown + EXPRESS West Coast Exploration.

Third, toxic metals and chemicals released during mining can bioaccumulate in marine organisms, adversely affecting deep-sea invertebrate organisms and fish.[32] Increased ambient metal concentrations could disrupt ecosystem composition and function, with implications for delivery of key ecosystem services,[33] including oxygen production.[34] In that connection, specific attention must be paid to new research revealing that polymetallic nodules in the deep seabed have a role in producing dark oxygen.[35] This previously unknown natural source of oxygen - without the involvement of plants - could be a critical element for deep-sea ecosystems, supporting known and unknown deep-sea lifeforms.

Testing of mining components has begun in some areas, with early experiments revealing significant environmental risks of full-scale mining, including sediment plumes and chemical pollution.[36] Meanwhile, critical knowledge gaps persist regarding baseline ecological data, taxonomic details, ecosystem structure and services, and overall impacts of this kind of mining in the deep seabed,[37] which indicate that we currently do not have enough knowledge to effectively manage DSM activities and prevent negative environmental impacts.

At the same time, existing scientific literature shows that DSM poses substantial risks of biodiversity loss and pollution of the marine environment, harming human rights.[38] This occurs in the context of ocean's degradation, including ocean acidification –a planetary boundary that has just been crossed,[39] already affecting the enjoyment of all human rights, including the rights to a clean, healthy and sustainable environment, to life, health, food, culture and education.[40] Impacts of DSM might disproportionately affect Indigenous Peoples, small-scale fishers, coastal communities and others, that depend on ocean ecosystems for their survival, among others.

The uptake of heavy metals and toxins due to DSM by marine animals and commercial fisheries may severely impact the rights to an adequate standard of health and adequate food of fisheries-dependent communities.[41] Indigenous Peoples, subsistence fishers, coastal communities and persons living in Large Ocean States (especially those in the Pacific) are heavily reliant on marine resources for food and livelihoods,[42] and thus are disproportionately exposed to health impacts and food insecurity due to the projected impacts of DSM,[43] including to their ancestral seas.[44]

Deep-seabed mining threatens the full enjoyment of human rights, including the human right to a clean, healthy and sustainable environment.

DSM also threatens spiritual and cultural practices of Indigenous Peoples,[45] including intangible underwater cultural heritage.[46] Additionally, by liberating carbon in sediments, weakening the ocean's carbon sequestration capacity and other services from the ocean, and through GHG-intensive processes,[47] ongoing research is clarifying the extent to which DSM may exacerbate climate change, intensifying its severe and compounding human rights impacts on marginalized individuals, communities,[48] and future generations.

It is crucial to highlight that a just transition away from fossil fuels must be grounded in human rights and the protection of our planet. The pursuit of critical minerals cannot come at the cost of people or nature.

State obligations to protect the marine environment and prevent harm, including from risks posed by DSM

General international obligations

Under international law, **States have the *erga omnes* obligation to prevent significant environmental harm, and must urgently take all appropriate measures to address foreseeable threats to human rights due to environmental degradation**[49]. This includes, adopting all available, reasonable measures to protect people from foreseeable threats to their human rights and particularly by adequately regulating and controlling polluting activities.[50] The *erga omnes* obligation of States to prevent environmental harm and the resulting human rights violations includes regulating, controlling and monitoring pollution, undertaking environmental impact assessments, and upholding the precautionary principle and ecosystem approach.[51]

Human rights obligations are complementary and parallel to broader inter-State due diligence obligations[52] **to prevent transboundary environmental harm.** Interpretation and implementation of these State obligations in the context of marine protection must therefore be informed by principles from both sets of legal obligations.[53] States' obligations under UNCLOS must thus be interpreted consistently with their obligations under international human rights law, international environmental law, and customary international law. This is consistent with the International Court of Justice (ICJ)[54] and the principle of systemic integration under Article 31(3)(c) of the Vienna Convention on the Law of Treaties, which requires treaty provisions to be interpreted in light of any relevant rules of international law applicable between the Parties.

As the International Tribunal of the Sea (ITLOS) and the ICJ concluded, in its interpretation of UNCLOS and international law obligations in relation to climate change, **States must act with stringent due diligence to prevent significant transboundary environmental harm.**[55] Although the standard of due diligence varies depending on the severity of the risk of harm involved, a State's contribution to it and its capacities to properly address it,[56] the ICJ concluded that regarding the prevention of significant harm to the climate system, the standard of due diligence is stringent.[57]

States also must maintain the ocean's integrity to protect the human rights of present and future generations,[58] ensuring non-regression in environmental standards and protections[59] and priority for the best interests of the child.[60] Conservation and management measures must take into account technical requirements imposed by international standards, the best available science, including the ancestral knowledge of Indigenous Peoples, local knowledge of small-scale fishers, and relevant environmental

and economic factors."[61] Human rights obligations are further complemented by **States' obligation under UNCLOS to protect the marine environment and preserve rare or fragile ecosystems** and the habitats of depleted, threatened or endangered species and other forms of marine life[62] from "pollution from installations and devices used in exploration or exploitation of the natural resources of the seabed and subsoil".[63]

Furthermore, the ITLOS Advisory Opinion on States' obligations on climate change and the ICJ Advisory Opinion on climate change are relevant for the protection of human rights from the risks of DSM related to climate change, namely to prevent future or potential marine pollution from GHG emissions from all sources, and to conserve marine biodiversity and restore marine ecosystem enhancing carbon sequestration.[64]

UNCLOS and the precautionary principle: applicable when there is a risk of harm to the environment, despite scientific uncertainty.

The precautionary principle requires States to adopt adequate measures to prevent environmental risks even if there is a lack of full scientific certainty about the risk.[65] The precautionary principle is applicable to DSM, as recognised by the ISA and ITLOS.[66] ITLOS acknowledged that under UNCLOS, precaution is inextricably related to States' due diligence obligation to prevent harm to the marine environment,[67] a conclusion shared by the ICJ.[68] Furthermore, precaution according to ITLOS constitutes "one of the most important of the direct obligations incumbent on sponsoring States" and the ISA in respect of activities in the Area.[69]

The precautionary principle is also incorporated in ISA's Regulations on Prospecting and Exploration of Nodules, Sulphides and Cobalt-Rich Ferromanganese Crusts in the Area, which codify it as a binding obligation for both sponsoring States and the ISA.[70] In relation to this, ITLOS considered that "it is to be expected that the Authority will either repeat or further develop this approach when it regulates exploitation activities and activities concerning other types of minerals."[71]

States must also uphold the precautionary principle to prevent human rights violations in the face of potential environmental damage, even in the absence of scientific certainty. This has been reaffirmed by the ICJ[72] and UN treaty bodies, including the Human Rights Committee,[73] the Committee on Economic, Social and Cultural Rights,[74] and the Committee on the Rights of the Child,[75] as well as regional human rights tribunals, including the Inter-American Court of Human Rights,[76] and the European Court of Human Rights.[77]

States must adopt a precautionary pause of DSM

The scientific understanding of the deep seabed, its ecosystems, its species and their interactions, including with other ecosystems, and the climate system, is increasing. The

existing ocean science offers far greater insight into the value and vulnerability of deep-seabed ecosystems than was available during the negotiation of UNCLOS. In contrast, the seafloor mining technology is still under development and its impacts on the marine environment are unknown.[78] Currently, there is a lack of sufficient and comprehensive knowledge of the extension of DSM impacts,[79] effective ways to prevent or mitigate them, and what broader repercussions may arise from those impacts upon the global population[80] and the environment. When the risks are severe and irreversible and science is uncertain, the only responsible course of action is precaution.

The scientific uncertainties surrounding DSM, together with its potential environmental harm and human rights violations, trigger the application of the precautionary principle as a matter of international law.[81] What is now urgently required is for States to effectively implement this obligation. At least 43 States, have already called for an official pause or moratorium on deep-seabed mining. [82]



Applying the precautionary principle to the current context requires, at a minimum, that States collectively and individually decide to pause any authorization regarding DSM activities. This decision should be taken during the ISA session. Such a pause is particularly needed given that discussions, negotiations, and assessments of the regulatory framework remain ongoing, alongside the existence of severe, irreversible, and unavoidable risks to the marine environment and human rights, and persistent scientific uncertainty regarding how to prevent them.

In further negotiating all regulations regarding DSM, States should:

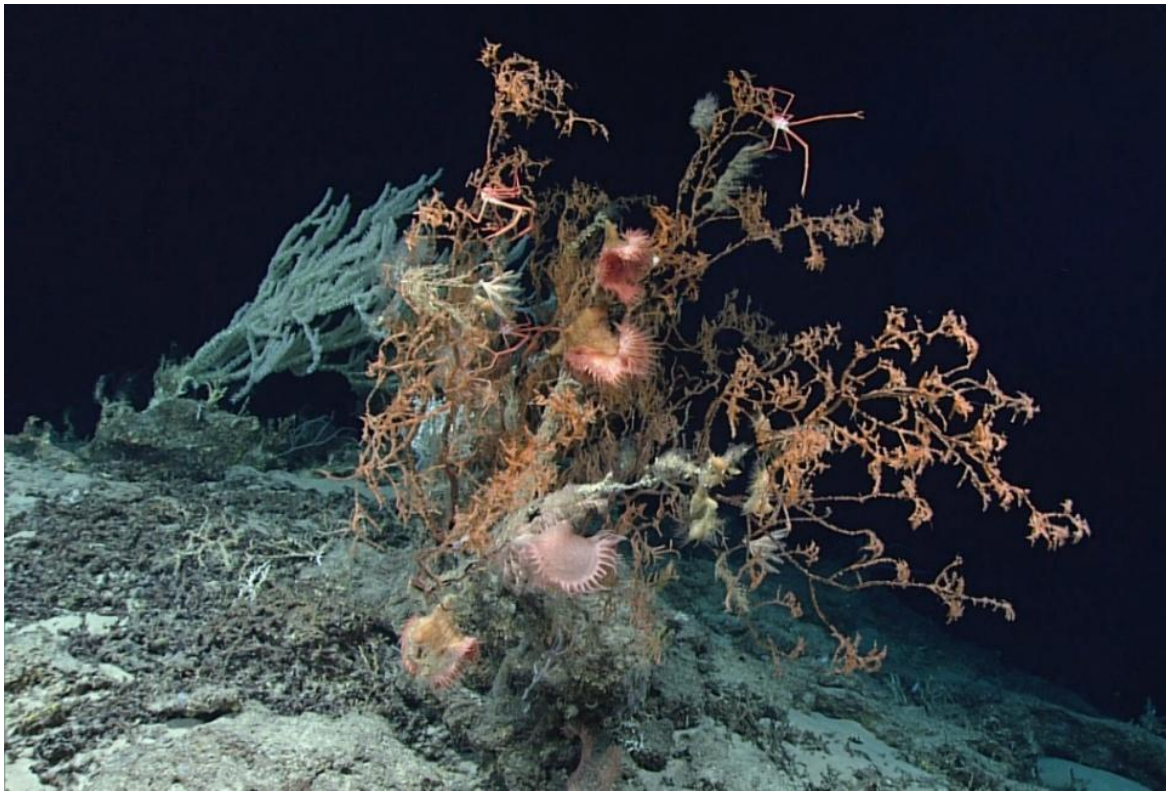
- Integrate the precautionary principle across all regulatory stages: the precautionary principle must guide decision-making in environmental impact assessment, test mining, performance evaluation, and post-approval monitoring, including through the development of relevant Standards and Guidelines.

- Codify a precaution-based burden of proof: contractors must demonstrate that proposed activities will not result in serious harm, particularly in cases where environmental baselines or ecosystem functioning remain insufficiently understood.

- Defer approvals: no DSM licenses should be approved until scientific certainty has been achieved regarding the identification, management and prevention of risk of serious or irreversible harm to the marine environment.

- Integrate human rights principles and obligations: all DSM regulations must ensure integration of the obligation to respect, protect, and fulfil human rights of Peoples and communities most threatened by DSM, including through adequate public participation, access to information, and access to justice.

Finally, it is important to highlight that States and the ISA must put in place adequate and non-regressive regulations and effective safeguards, following a meaningful and transparent public participatory process based on the best available science, including Indigenous knowledge and local knowledge, in accordance with a human rights-based approach.[83] Doing so will allow enough time to thoroughly, independently, and objectively assess its risks, including projected GHG emissions of mining activities and other impacts on the climate. A precautionary pause or moratorium on DSM would also allow for the establishment of adequate, effective and participatory measures to avoid the risks posed by DSM today.



This large outcrop with several large coral colonies was seen at 760 meters (2,493 feet) depth. Large corals, such as the black coral shown here, can host an abundance of associates, including several flytrap anemones (Actinoscyphia aurelia) and squat lobsters. These associates use the coral to get farther off the seafloor and into nutrient-delivering currents. Image courtesy of the NOAA Office of Ocean Exploration and Research, Windows to the Deep 2019.

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[58] ICJAO at para. 157 and 273.
[59] *The ocean and human rights,* A/HRC/58/59, *supra* note 3 at para. 73. See also Agreement under the United Nations Convention on the Law of the Sea on the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (BBNJ), preamble; and Maastricht Principles on the Human Rights of Future Generations.
[60] CRC GC26; Report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment, A/HRC/37/58, 24 January 2018.
[61] *The ocean and human rights,* A/HRC/58/59, *supra* note 3 at para. 73. ITLOS, *supra* note 51 at para. 414.
[62] Considered in the context of the Convention on Biological Diversity and the Kunming-Montreal Global Biodiversity Framework, that duty also entails conserving and managing at least 30 per cent of the ocean as protected areas by 2030. See also, UNCLOS, art. 194.
[63] UNCLOS, arts. 194.3.c, 208, and 214.
[64] ICJ at paras. 342 and 343. *Access to information on climate change and human rights- Report of the Special Rapporteur on the promotion and protection of human rights in the context of climate change*, A/79/176 and *Scene-setting report*, A/HRC/56/46 *supra* note 47.
[65] Rio Declaration on Environment and Development, *supra* note 52, principle 15, ICJAO at para. 158.
[66] See eg Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area, ISBA/19/C/17, 22 July 2013, regulation 31(2).
[67] ITLOS, *supra* note 53, at para. 213.

[68] ICJAO at para. 294.
[69] ITLOS Seabed Disputes Chamber, Advisory Opinion on the Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area, 1 February 2011, paras. 122, 127, 131.
[70] Regulations on prospecting and exploration for polymetallic sulphides in the Area, ISBA/16/A/12/Rev.1, 15 November 2010, regulations 2, 5, 33; Amendments to the regulations on prospecting and exploration for polymetallic nodules in the Area and related matters, regulations, ISBA/19/A/9, 25 July 2013 regulations 2, 5, and 31, and regulations on prospecting and exploration for cobalt-rich ferromanganese crusts in the Area, ISBA/18/A/11, 22 October 2012, regulations 2, 5, 31.
[71] ITLOS Seabed Disputes Chamber, *supra note* 63, para. 130.
[72] ICJAO at para. 294.
[73] Human Rights Committee, General Comment No 36 (2018) on Article 6 of the International Covenant on Civil and Political Rights, on the right to life (30 October 2018) UN Doc CCPR/C/GC/36, para 62.
[74] Committee on Economic, Social and Cultural Rights, General Comment No. 25 (2020) on science and economic, social and cultural rights, E/C.12/GC/25, 30 April 2020, para 56.
[75] Committee on the Rights of the Child, General Comment No. 26 (2023) on children's rights and the environment, with a special focus on climate change, CRC/C/GC/26, 22 August 2023, para. 69
[76] IACtHR, *State Obligations in relation to the environment in the context of the protection and guarantee of the rights to life and to personal integrity: Interpretation and scope of Articles 4(1) and 5(1) in relation to Articles 1(1) and 2* Advisory Opinion OC-23/17, and *Case of the Inhabitants of La Oroya v Peru*, Preliminary Objections, Merits, Reparations and Costs (27 November 2023), para. 416.
[77] ECtHR, *Tătar v Romania* (27 January 2009) App no 67021/01, para. 109.
[78] Ibid.
[79] E Popova et al, "So far, yet so close: ecological connectivity between ABNJ and territorial waters" IIED Policy Brief 2019, https://pubs.iied.org/17500iied.
[80] K Miller et al, 'An Overview of Seabed Mining Including the Current State of Development, Environmental
Impacts, and Knowledge Gaps' (2018) 4 *Frontiers in Marine Science* 418.
[81] *The ocean and human rights*, A/HRC/58/59 *supra* note 3. The Office of the High Commissioner for Human Rights, the Conference of the Parties to the Convention on Biological Diversity, and numerous civil society organizations, have underlined the need to apply the precautionary principle to DSM. OHCHR. *Key Human Rights Considerations on the Impact of Seabed Mining*, 2023; CBD 'Decision 15/24. Conservation and sustainable use of marine and coastal biodiversity' UN Doc CBD/COP/DEC/15/24 (17 November 1995) para 16; Deep Sea Conservation Coalition: https://deep-sea-conservation.org/solutions/no-deep-sea-mining/ and Seas at Risk: https://seas-at-risk.org/what-we-do/ocean-use/saving-deep-sea-from-mining/
[82] *The ocean and human rights,* A/HRC/58/59, *supra* note 3 at para. 60. See also Deep Sea Conservation, Momentum for a Moratorium: https://deep-sea-conservation.org/solutions/no-deep-sea-mining/momentum-for-a-moratorium/; G7 countries say strict environmental rules needed for deep-sea mining, Reuters (May 27, 2022), https://www.reuters.com/world/g7-countries-say-strict-environmental-rules-needed-deep-sea-mining-2022-05-27/
[83] *The ocean and human rights*, A/HRC/58/59, *supra* note 3 at para. 100(c).