LOG17-007: Communication from the United Nations Office of Legal Affairs

Executive Summary

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report,[1] identified that human induced warming of atmosphere and ocean is unequivocal. Climate change has impacted natural and human systems across all continents and the oceans. Sea level has risen. The risk of extreme events and their intensity has increased. Arctic sea ice has declined. Ocean acidity has increased. With 93% of heat attributed to global warming and 28% of anthropogenic CO_2 emissions ending up in the oceans,[2] oceans have acted as the most important mitigation factor of climate change thus far.

Furthermore, sea level rise will continue for centuries even if the global mean temperature is stabilized. The decline of arctic sea ice could lead to new trade routes and access to regional resources for exploitation and tourism but would seriously impact arctic ecosystems.[3]

The **United Nations Framework Convention on Climate Change** (UNFCCC),[4] **Article 4.1** (commitments) states: "All Parties shall promote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases (GHGs), including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems".

Scientific aspects of oceans are discussed under the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA),[5] most recently highlighted are: verification of deep ocean warming to 2000m which is impacting sea level rise and ecosystems health;[6] regional variations in sea level rise with a consequence for planners;[7] and, possible slowdown of the deep ocean circulation with a serious impact on the planet, including nutrient supply for Pacific, Atlantic and Indian ocean ecosystems; heat uptake; and the ocean's capacity to function as a CO_2 sink.[8]

The **Paris Agreement**[9] mentions oceans in the preambular paragraphs: "Noting the importance of ensuring the integrity of all ecosystems, including oceans, …". It is not yet clear what the role of the oceans will be in implementing **Article 4.1** to achieve the long-term temperature goal of **Article 2** and peak GHGs as soon as

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1 IPCC Fifth Assessment Report < https://www.ipcc.ch/report/ar5/>.

2 IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex andP.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324.

3 See IPCC WG II, 6.4.1 and <http://unfccc.int/files/science/workstreams/research/application/pdf/6_ipcc_wgii_polar_ocean_summary_poertner.pdf>.

4 <http://unfccc.int/6036>.

5 See agenda item on Research and Systematic Observation <http://unfccc.int/6990> and the summary reports of the research dialogues <http://unfccc.int/6793>.

6 <Roemmich D, Church J, Gilson J, Monselesan D, Sutton P and Wijffels S (2015). Unabated planetary warming and its ocean structure since 2006. Nature Climate Change 5, 240–245. <http://dx.doi.org/10.1038/nclimate2513>.

7 <Slangen ABA , Carson M , Katsman CA , van de Wal RSW , Köhl A , Vermeersen LLA and Stammer D (2014). Projecting twenty-first century regional sea-level changes , Climatic Change 12 4 (1), 317-332. <http://dx.doi.org/ 10.1007/s10584-014-1080-9>.

8 <Rahmstorf, S., Box, J., Feulner, G., Mann, M., Robinson, A., Rutherford, S., Schaffernicht, E. (2015): Exceptional twentieth-century slowdown in Atlantic Ocean overturning circulation. Nature Climate Change (online)>.

9 <http://unfccc.int/9485>.

possible and then rapidly reduce emissions, according to the best available science, so as to achieve carbon neutrality in the second half of this century.

The **Intended Nationally Determined Contributions (INDCs)**[10] of Parties to the UNFCCC identify a number of key issues for oceans and mitigation, adaptation and climate resilient sustainable development. This includes needs for observation, research, capacity building, improved institutional arrangements and legal and policy frameworks, and actions including in regards to emissions reductions, livelihood diversification, conservation and risk management.

The **Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts** is a pillar of the Paris Agreement and is addressing loss and damage including as a result of sea level rise and ocean acidification.

Full text

Action undertaken to address the effects of climate change on the oceans and to foster climate resilient sustainable development of oceans and seas

Science, data collection and awareness raising

The **IPCC**, in its Fifth Assessment Report provided an in depth study of Impacts, Adaptation, and Vulnerability in regards to the Ocean: this is collected together in the digital document: The **IPCC Oceans Compendium: Climate Change and the Ocean**: Special Collection of Reprints from the Working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change: <https://www.ipcc.ch/report/ar5/wg2/docs/WGII-AR5_Oceans-Compendium.pdf>.

The **IPCC** is preparing a **Special report on climate change and the oceans and the cryosphere** which will be available in **2019**. It will be developed under the joint scientific leadership of Working Groups I, II and III with the support of the WGII Technical support unit.

The UNFCCC mentions oceans under Article 4.1 (commitments): all Parties shall promote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases, including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems. The Paris Agreement only mentions oceans in the preambular paragraphs – "Noting the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity…". However, it is not clear what the role of the oceans will be in implementing the Article 4.1 of the Paris Agreement – "In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century…". When this was written, models and scenarios assumed that the ocean will remain a sink until 2100 (about 30% of anthropogenic emissions). However, with increased use of negative emissions for low temperature stabilization oceans may become a source, starting to release the CO2 they stored from what we already emitted.

Actions and activities in regards to science, data collection and raising awareness on oceans are addressed under the SBSTA.

[10] <http://unfccc.int/8766>.

A. Systematic Observation (SBSTA): At COP 22, the Earth Information Day[11] provided the opportunity to optimize engagement and connect information and requirements between the science community, Party and non-Party stakeholders to benefit the intergovernmental process and Paris Agreement implementation. It focused on providing an up-to-date picture of the state of the climate, including of oceans and a future outlook on developments and opportunities to support decision making on risk assessment, adaptation and mitigation at regional and national level. The outcome will be captured in a Summary report by the SBSTA Chair to be made available by May 2017.

The Earth Information Day featured speakers from the heads of UN and international science organizations and agencies and the scientific community including on the state of the climate and the global carbon budget; the development of indicators to support adaptation and mitigation; the GCOS 2016 Implementation Plan[12] – including ocean aspects.[13]

Key highlighted information from the Earth Information Day was that with 93% of heat attributed to global warming and 28% of anthropogenic CO_2 emissions ending up in the oceans,[14] oceans have acted as the most important mitigation factor of climate change thus far.

Scientific data and knowledge on oceans has increased in the last few decades but more needs to be done, including at greater depth (beyond 2000m) and on new variables, to fully monitor climate change impacts including on ocean life and food supply, human livelihoods, coastal impacts, ocean system services and extreme events.

In regards to the ocean, attaining and sustaining global observation coverage is the most significant challenge of the oceanic climate observing system.

The central role of the ocean in climate change is not reflected in detail under the UNFCCC, with only one reference to oceans in the preambular to the Paris Agreement. Although scientific aspects of oceans are discussed under the SBSTA research and systematic observation agenda item.

B. Research (SBSTA): The annual SBSTA research dialogue, which takes place during the first sessional period of the year, is a forum for Parties, in particular developing country Parties, and regional and international research programmes and organizations active in climate change research to:

(a) Discuss needs for climate change research and research-related capacity-building, particularly those of developing countries, to support the work of the Convention;

(b) Convey research findings and lessons learned from activities undertaken by regional and international research programmes and organizations of relevance to the Convention.

The focus of the research dialogue is directed each year by Parties to the Convention through submissions to the UNFCCC secretariat.

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[11] <http://unfccc.int/9949>.

[12] <http://unfccc.int/files/science/workstreams/systematic_observation/application/pdf/gcos_ip_10oct2016.pdf>.

[13] See <http://unfccc.int/files/adaptation/application/pdf/i.3__ioc_tanhua.pdf> and <http://unfccc.int/files/science/workstreams/systematic_observation/application/pdf/3.unesco_ioc_fb2_ch_tanhua_cop22.pdf>.

[14] [14] IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex andP.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324.

At the **research dialogue** several issues linked to oceans, including observation (e.g. temperature and heat content, acidification, oxygen depletion, sea level rise, sea ice), impacts on marine ecosystems, coastal zones, ecosystem services and slow onset events at different warming scenarios have been addressed. For example:

- At RD7[15] (May 2015) new findings on how oceans absorb heat was presented by the Chair of WGI ahowing an increased uptake of heat at different layers in the ocean in the last eight years, which is relevant for ecosystems health and sea level rise[16].
- At RD8[17] (May 2016), updates were provided from IPCC WGI on sea level rise and on the CO_2 storages in the oceans (Global carbon project)
- At RD8 Mr. Alexandre Magnan, France, highlighted recent research showing the contrasting futures for ocean and society as a result of slow onset climate-related changes. The level of impacts by the end of the century will strongly depend on the greenhouse gas mitigation trajectories the world will follow (see figure below).[18]

[15] <http://unfccc.int/files/adaptation/application/pdf/researchdialogue.2015.2.summaryreport.pdf>.

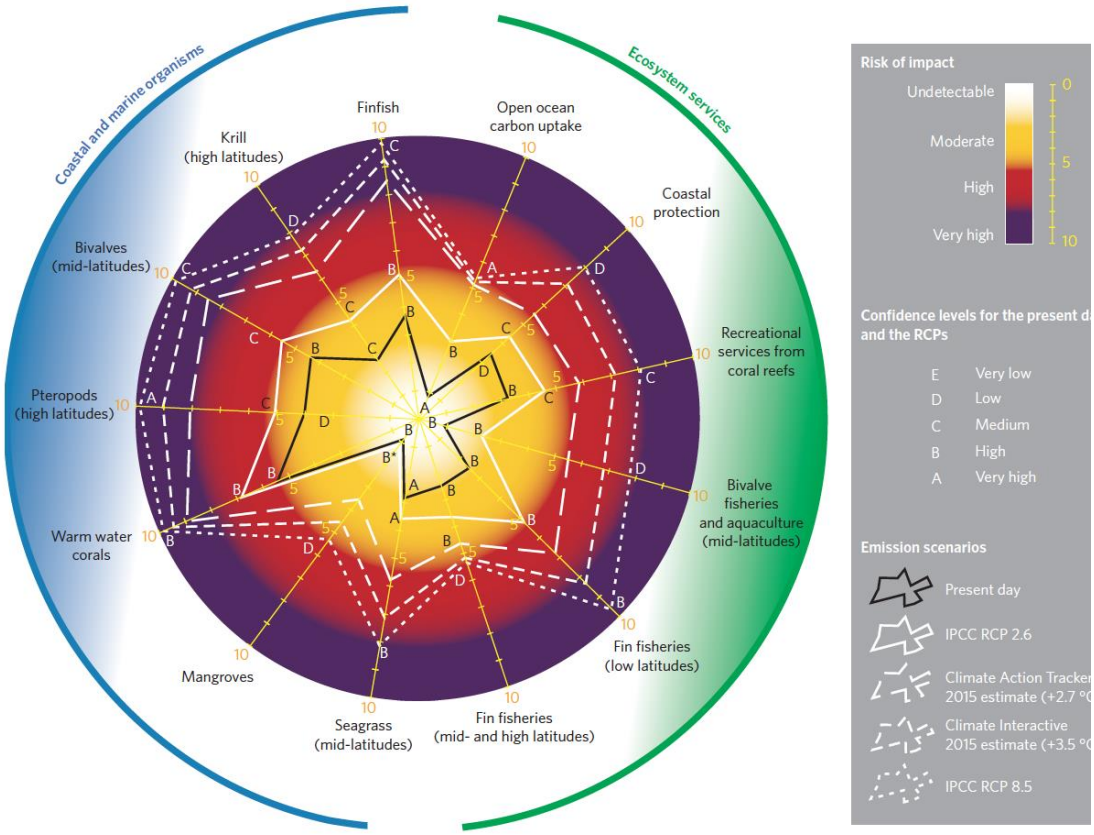
[16] Roemmich D, Church J, Gilson J, Monselesan D, Sutton P and Wijffels S (2015). Unabated planetary warming and its ocean structure since 2006. Nature Climate Change 5, 240–245. <http://dx.doi.org/10.1038/nclimate2513>

[17] <http://unfccc.int/files/science/workstreams/research/application/pdf/researchdialogue_2016_2_summaryreport.pdf>.

[18] <http://unfccc.int/files/science/workstreams/research/application/pdf/part2_france_magnan_poster.pdf>. See also Magnan et al. (2016). Implications of the Paris Agreement for the ocean, Nature Climate Change. <http://rdcu.be/iigT>.

Figure 1

Linking ocean risks to iNDCs and the global stocktake, to be assessed in the sixth assessment cycle of IPCC



Source: Magnan et al. 2016. Nature Climate Change. This figure looks at different warming scenarios, including the estimated projected global surface temperature warming of the current INDCs, estimated at 2.7 ºC and 3.5 ºC by different organizations, and assesses the risk to the oceans in terms of ocean organisms/biota (e.g. bivalves, warm water corals, mangroves etc.) in blue and ecosystem services (coastal protection, open ocean carbon uptake, fisheries etc.) in green. The figure demonstrates that the present day risk-level (represented by black lines in the centre) for the oceans is mostly moderate (except for mangroves, open ocean carbon uptake, and bivalve fisheries and aquaculture, for which the risk level is undetectable) and that although the risk level does increase, the oceans remain in this moderate category with 1.5 ºC of warming for the most part (except for warm water coral reefs, which will be at a high-level of risk). The figure also demonstrates that the two estimated pathways presented in the current Intended Nationally Determined Contributions (INDCs) would lead to high and very high levels of risk for almost all of the ocean organisms and services, and this should motivate higher ambition in climate mitigation

In 2013, SBSTA held a **research workshop** on technical and scientific aspects of ecosystems with high-carbon reservoirs not covered by other agenda items under the Convention (including marine ecosystems – blue carbon). The workshop addressed both adaptation and mitigation aspects and concluded with some recommendations, including for IPCC.[19] These recommendations, together with any other recommendations the SBSTA may provide in future, could be considered by IPCC in the revised report on the methodological guidance that will be produced by 2019.

[19] <http://unfccc.int/resource/docs/2014/sbsta/eng/inf01.pdf>.

Actions and activities that have been undertaken to address the effects of climate change on the oceans and to foster climate-resilient sustainable development of oceans and seas

In the context of the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts

COP 19 (November 2013) established the Warsaw International Mechanism for Loss and Damage (Warsaw International Mechanism), to address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change.

Slow onset events as identified by the COP include **sea level rise and ocean acidification**, as well as other incremental impacts such as salinization, land and forest degradation, loss of biodiversity, increasing temperatures, glacial retreat, and desertification.

The Paris Agreement identifies, inter alia, slow onset events and events that may involve irreversible and permanent loss and damage, as areas of cooperation and facilitation to enhance understanding, action and support (Article 8.3 of the Paris Agreement).

The Warsaw International Mechanism promotes the implementation of approaches to addresses loss and damage in three ways:

- Enhancing knowledge and understanding of comprehensive risk management approaches;
- Strengthening dialogue, coordination, coherence and synergies among relevant stakeholders;
- Enhancing action and support, including finance, technology and capacity–building.

The Executive Committee of the Warsaw International Mechanism (Executive Committee) guides the implementation of these functions through its workplan. Relevant activities undertaken to date include a mapping of those organizations that are contributing to enhancing data and knowledge of risks of slow onset events associated with the adverse effects of climate change. Key results of this mapping is contained in an online database which includes information on over 40 organizations that are working ocean-related climate change impacts, e.g. Washington Ocean Acidification Center, International Ocean Institute, Global Ocean Observing System. See the database for further details <http://www4.unfccc.int/sites/NWP/Pages/soesearch.aspx>.

Vulnerability and adaptation under the Intended Nationally Determined Contributions (INDCs)

The below list contains a general overview of ocean-related information contained in the adaptation components of INDCs of Parties to the UNFCCC. The information provides examples contained in the INDCs for the topics of interest. It does not reflect all vulnerabilities and adaptation measures expressed in the INDCs related to the ocean.

1. **Science, data collection and awareness raising:**

   - Global climate models do not accurately reflect temperature increase because the entire region is represented only as ocean grid boxes. (ATG);
   - Capacity is required to set up an observation and monitoring system, including for the ocean (BEN);
   - This is a lack of capacity of, i.a., oceanographic services (GNB);
   - Urgent technical work is needed to assess impacts of different CO2 levels on risks including ocean acidification and sea level rise (NRU);
   - Research is needed to better understand changes in i.a. ocean currents (SYC).

2. **Overview of existing legal and policy frameworks;**

3. **Action aimed at fostering climate resilient sustainable development of oceans and seas;**

4. **Ocean-based adaptation actions/Ocean-based mitigation action;**

Examples of adaptation of fisheries (ca. 42 countries outlined adaptation actions related to fisheries):

   - FAO project to build resilience and reduce vulnerability of the Benguela Current fisheries system; research on vulnerability of fisheries (AGO);
   - Promoting an ocean-based "blue" economy through new aquaculture techniques, ecolabels, and sustainable maritime tourism and sports. (CPV);
   - Climate-resilient fisheries (DOM, GHA, KEN, MUS), including stress tolerant varieties (BGD);
   - Agro-economic systems (EGY)/aquaculture production systems (KHM);
   - Sustainable fishing techniques, training, better equipped boats (ERI);
   - Fisheries Strategic Action Plan, including fish farming, protection of landing sites and facilities from flooding (GMB);
   - Action plans for fisheries, aquaculture, and coastal and marine resources (estimated cost of efforts in the fisheries sector is 500,000-750,000 USD) (BLZ);
   - Equip 100% of fishing boats with sufficient communication equipment (VNM);

– Diversify fisheries sector, develop insurance mechanism for fishermen (MDV).

Examples of coastal protection (ca. 54 countries outlined actions for coastal protection):

– Strategies to protect coastlines (BHS)/coastal zone management (BRB);

– Coastal and flood protection (BRU);

– Build sea dykes (KHM);

– Stop receding shorelines in most affected areas (MDG).

Examples of measures to preserve marine ecosystems:

– Develop marine protected areas (ERI); establish a 150,000 ha marine protected area (BRU), double the number of marine protected areas by 2030 (TON); protect 20% of marine environments by 2020 (BHM);

– Enhance resilience of coastal ecosystems and coastal wetlands (BHS);

– Undertake adaptation measures for the biodiversity of oceanic island water systems (CHL);

– Promote coral reefs conservation through an ecosystems approach and appropriate sewage treatment systems (MDV);

– Protect, conserve, and manage oceans (VEN);

– Expand marine tourism (SYC).

5. Capacity-building, partnerships and financing

Effects of climate change on the oceans – environmental, social and economic

1. Ocean warming

(i) Effects on marine ecosystems and biodiversity:

i. Environmental

– Surface temperature warming and land-based pollution lead to significant coral bleaching (NRU, NIU, MDV);

– Significant damage to ecosystems due to environmental degradation (NRU).

ii. Social and economic

– ca. 30 countries identify fisheries as vulnerable;

– Fisheries sector and tourism will be impacted by increasing sea surface temperatures, and Sargassum weed influx (ATG);

– Warming oceans threaten the health and sustainability of ecosystems that sustain fisheries (DOM);

– Ocean warming will heavily impact coral reefs, fisheries, and other marine-based resources crucial to our livelihoods, economy, and culture (PAL).

(ii) Effects on marine species

i. Environmental

– Higher sea surface temperatures impact migration patterns of fish (MRT)

– Abundance of key fish species will be affected by changes in ocean currents (NRU)

ii. Social and economic

– Fish populations are declining due to climate change and other factors (MWI); tuna populations are expected to move (MDV)

(iii) Sea-level rise

– **Identified as a key climate risk by ca. 61 countries, ca. 52 countries refer to coastal areas as particularly vulnerable.**

– Other risks associated with sea level rise were also emphasized in the INDCs, for example:

– Ca. 20 Parties highlighted saltwater intrusion as a risk;

– Ca. 27 Parties are concerned about coastal erosion.

– In their INDCs, some countries referred to observed sea level rise, ranging from 10 to 30 cm in the past 100 years or 1.4 to 3 mm per annum. One country highlighted the global increase of 1.7 mm per annum in the period 1901–2010, while another one stated that its coastline has moved by 1.2 m per year due to sea level rise of 1.43 mm per annum.

– Estimates of sea level rise range from 60 to 70 cm under a 2 °C scenario, as well as 0.81 m by 2100, depending on location and temperature scenarios.

i. Environmental

– […]

ii. Social and economic

– Two countries indicated that they are at risk of losing significant amounts (ranging from 12 to 70 per cent) of economically important land in river deltas due to sea level rise (EGY);

– Another country stated that 42 million people might be affected by sea level rise due to its long coastline (IDN);

– One meter of sea level rise would impact 10% of tourism resorts, all seaports, and 2% of major road networks (ATG);

– Will affect productivity of fisheries and majority of population and economic activities (tourism), and cause loss and damage to key infrastructure located on coasts (BRB);

– Sea level rise and costal erosion threaten fisheries infrastructure (MRT);

– Threatens saltwater intrusion into groundwater reserves and coastal erosion (NRU);

– Threatens coastal communities with flooding and fishing grounds (e.g. wetlands, coral reefs, and mangrove areas) (SOM).

(iv) Melting ice in Polar regions - Environmental /biodiversity

i. Social and economic

(v) Extreme weather events - Environmental

– **Extreme weather is identified as a key climate risk by ca. 100 countries, while ca. 50 countries highlight risks posed by storms.**

– Many Parties highlighted extreme weather in its different forms such as stronger wind and rain, cyclones, typhoons, hurricanes, sea surges, sandstorms and heatwaves.

i. Social and economic

– Bangladesh is particularly susceptible to cyclones bringing heavy rains from the Indian Ocean (BGD);

– Most of economic activity is concentrated on the coasts. Therefore, extreme events on the coast threaten economic growth (MRT);

– Tropical cyclone Nargis caused the loss of 138,000 lives in 2008 (MMR);

– In 1999 Hurricane Lenny reduced the capacity of the Roseau Fisheries Complex to the extent that a year's catch could not be stored properly and much revenue was lost (DOM);

– Hurricane Ivan caused a loss of 8% of GDP (JAM).

2. Carbon dioxide flux and ocean acidification

– **Ocean acidification is identified as a climate risk by ca. 27 countries;**

– Parties referred to slow onset impacts, such as ocean acidification and coral bleaching.

(i) Environmental

– Increase of acidity observed since the 18th century (aragonite saturation rate has declined from 4.5 to 3.9 by 2000) and projected to increase and sink below 3.5 by 2030/2055 (on different islands); >25% of live coral will

be lost by 2035 and >50% by 2050 (KIR);

– Acidification is accompanied by increase in jellyfish numbers and micro-algae (MRT);

– Ability of corals and invertebrates to form will be affected by ocean acidification (NRU);

(ii) Social and economic

– Ocean acidification is:

  – Causing serious impacts on lives and livelihoods (BGD);

  – Threatening fisheries, diving and whale-watching industry (DOM);

  – Impacting biodiversity, incomes, and food security (KIR);

  – Causing water and food security issues (MHL).

3. Cumulative impacts

(i) interaction with other drivers

– Position between two oceans makes the country highly vulnerable (CRI, GTM, MEX);

– Small land area separated by vast oceans makes the country highly vulnerable (KIR);

– Ocean pollution impacts coral reefs, with consequences for fishing and tourism (BLZ, DOM, MLV).