

**Supplementary Material**  
**Opportunities for increasing ocean action in climate strategies**

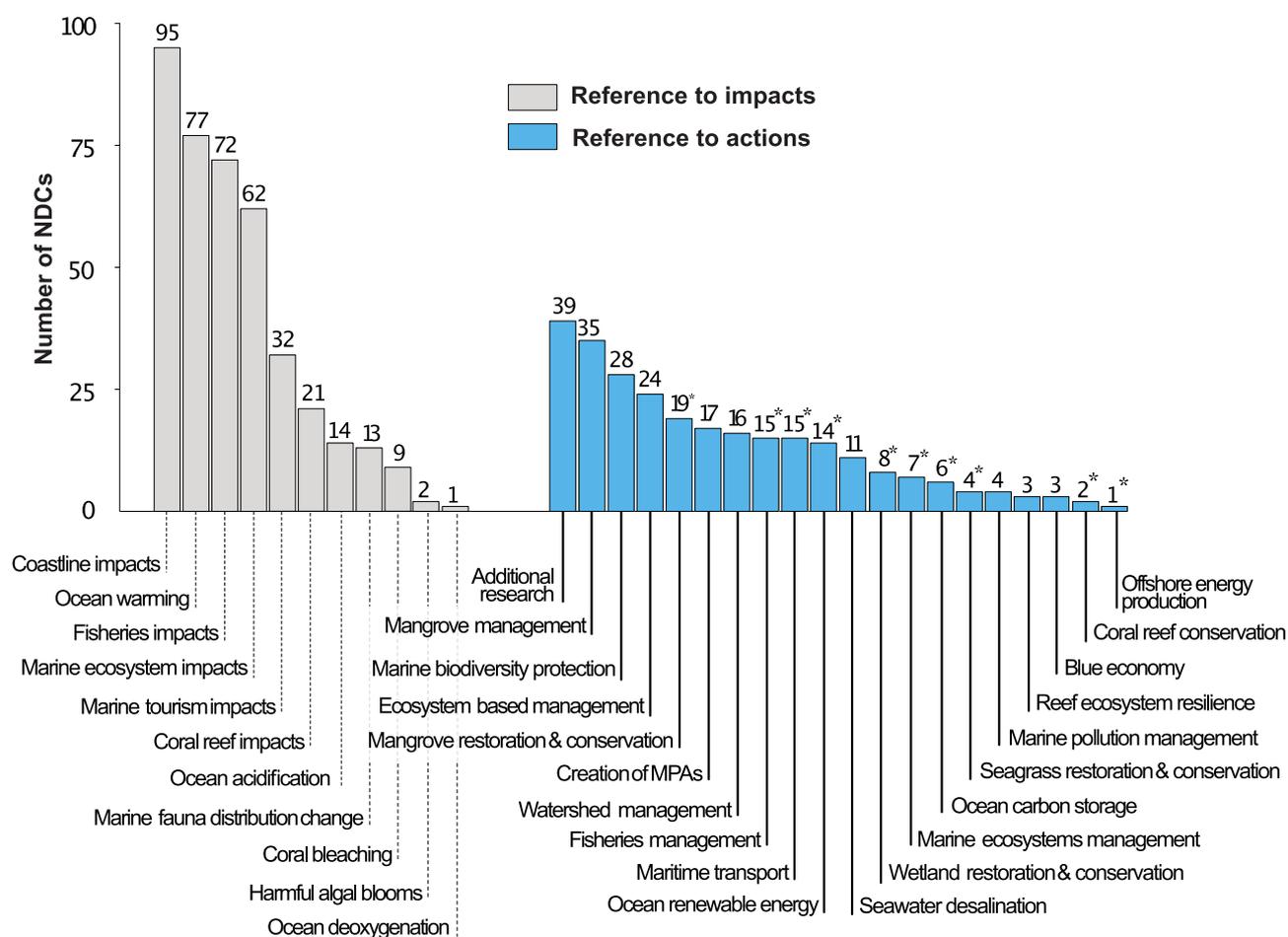
***Iddri Policy Brief n° 02/19***

<http://bit.ly/2NswD9t>

Jean-Pierre Gattuso\* (CNRS, Sorbonne University, Iddri), Alexandre K. Magnan (Iddri), Natalya D. Gallo (Scripps Institution of Oceanography, University of California San Diego), Dorothée Herr (IUCN), Julien Rochette (Iddri), Lola Vallejo (Iddri), Phillip Williamson (University of East Anglia, NERC)

\* Email contact: [gattuso@obs-vlfr.fr](mailto:gattuso@obs-vlfr.fr)

## SM1 – Overview of references to the ocean in countries' first Nationally Determined Contributions



**Figure SM1.** Overview of references to the ocean in countries' first Nationally Determined Contributions (2014-2015; NDCs). The 31 categories provide a qualitative representation of how different countries included marine issues in their NDCs. The classification results from a clustering exercise, as NDCs often mention different terms to describe the same type of impact or action, and is from Gallo et al. (2017). Numbers above the bars represent the number of NDCs (out of 161 analyzed) that included each category; numbers with an asterisk (\*) indicate categories in the mitigation component of the NDCs.

## SM2 – Brief glossary of the ocean-based measures

### Addressing the causes of climate change

**Marine renewable energy:** Ocean energy substitution for fossil energy, including energy from offshore winds, tides, waves, ocean currents as well as thermal gradients

**Reducing atmospheric pollution:** Reduce emissions of gases and black carbon from shipping

**Carbon capture and storage:** Sub-seafloor storage of carbon dioxide (CO<sub>2</sub>) captured from land-based power plants (using fossil fuels or biomass) or directly from the air in reservoirs considered to be geologically-secure

**Marine bioenergy with carbon capture and storage:** Use of marine biomass to generate energy and resulting CO<sub>2</sub> is captured and stored

**Restoring and increasing coastal vegetation:** Restoration and conservation of coastal vegetation to enhance CO<sub>2</sub> uptake and avoid further emissions

**Enhancing open-ocean productivity:** Adding nutrients directly or indirectly to increase CO<sub>2</sub> drawdown by phytoplankton (microscopic plants)

**Enhancing weathering and alkalization:** Addition of alkalinity to enhance CO<sub>2</sub> removal and carbon storage

### Supporting biological and ecological adaptation

**Pollution reduction:** From all sources that affect ocean ecosystems, including from land and rivers

**Assisted evolution:** Genetic modifications to assist survival under climate change

**Conservation:** Protect marine and coastal habitats and ecosystems, e.g. through marine protected areas

**Restoring and enhancing habitats:** Actions to restore and improve coastal habitats, ecosystems and ecosystem services, that may include ecological engineering and assisted migration

### Enhancing societal adaptation

**Community-based adaptation,** e.g. local management of fisheries, use of, traditional knowledge

**Infrastructure-based adaptation:** Physical structures, such as seawalls

**Relocating and diversifying economic activities,** e.g. move aquaculture and fishing industries to new areas, develop new tourism activities

**Relocating people,** either internally (i.e. at a local scale or within the country) or internationally

**Improving risk-reduction policies,** e.g., through improved monitoring and early warning systems, or better planning regulations in flood-prone areas

### Solar radiation management

**Cloud brightening:** Adding condensation nuclei (such as sea salt) to the lower atmosphere to enhance cloud brightness and longevity

**Surface albedo enhancement:** Increase ocean reflectivity by covering the ocean surface with long-lived foam

### SM3 – Additional relevant references

- C2G, 2019. *C2G Evidence Brief: Governing Nature-Based Solutions to Carbon Dioxide Removal*. Carnegie Climate Governance Initiative (C2G). New York. 27 p. Version 20190824; [www.c2g2.net/wp-content/uploads/c2g\\_evidencebrief\\_NBS.pdf](http://www.c2g2.net/wp-content/uploads/c2g_evidencebrief_NBS.pdf).
- C2G, 2019. *C2G Evidence Brief: Governing Marine Carbon Dioxide Removal and Solar Radiation Management*. Carnegie Climate Governance Initiative (C2G). New York. 28 p. Version 20190809; [www.c2g2.net/wp-content/uploads/c2g\\_evidencebrief\\_marine.pdf](http://www.c2g2.net/wp-content/uploads/c2g_evidencebrief_marine.pdf)
- Because the Ocean, 2019. Ocean for climate: ocean-related measures in climate strategies, <https://www.becausetheocean.org/ocean-for-climate/>
- Bindoff N. L., Cheung W. W. L., Kairo J. G., Aristegui J., Guinder V. A., Hallberg R., Hilmi N., Jiao N., Karim M. S., Levin L., O'Donoghue S., Purca Cuicapusa S. R., Rinkevich B., Suga T., Tagliabue A. & Williamson P., 2019. Chapter 5. Changing ocean, marine ecosystems, and dependent communities. In: Pörtner H.-O., Roberts D., Masson-Delmotte V. & Zhai P. (Eds.), *Special Report on Ocean and Cryosphere in a Changing Climate*. Geneva: Intergovernmental Panel on Climate Change.
- Froehlich H. E., Afflerbach J. C., Frazier M. & Halpern B. S., 2019. Blue growth potential to mitigate climate change through seaweed offsetting. *Current Biology* 29:3087-3093
- GESAMP, 2019. High level review of a wide range of proposed marine geoengineering techniques. *GESAMP Reports and Studies* 98:1-143.
- Hoegh-Guldberg O., Caldeira K., Chopin T., Gaines S., Haugan P., Hemer M., Howard J., Konar M., Krause-Jensen D., Lindstad E., Lovelock C. E., Michelin M., Nielsen F. G., Northrop E., Parker R., Roy J., Smith T., Some S. & Tyedmers P., 2019. *The ocean as a solution to climate change: five opportunities for action*. 111 p. Washington, DC: World Resources Institute. [https://www.ourdynamicplanet.com/wp-content/uploads/2019/09/HLP\\_Ocean\\_Solution\\_Climate\\_Change.pdf](https://www.ourdynamicplanet.com/wp-content/uploads/2019/09/HLP_Ocean_Solution_Climate_Change.pdf)
- International Energy Agency, 2019. Global energy & CO<sub>2</sub> status report. 28 p. Paris: International Energy Agency.
- Laffoley D., Baxter J. M., Amon D. J., Currie D. E. J., Downs C. A., Hall-Spencer J. M., Harden-Davies H., Page R., Reid C. P., Roberts C. M., Rogers A., Thiele T., Sheppard C. R. C., Sumaila R. U. & Woodall L. C., 2019. Eight urgent, fundamental and simultaneous steps needed to restore ocean health, and the consequences for humanity and the planet of inaction or delay. *Aquatic Conservation: Marine and Freshwater Ecosystems*, doi: 10.1002/aqc.3182
- Martin A., Landis E., Bryson C., Lynaugh S., Mongeau A. & Lutz S., 2016. Blue carbon - Nationally Determined Contributions inventory. Appendix to: Coastal blue carbon ecosystems. opportunities for Nationally Determined Contributions. 23 p. Norway: GRID-Arendal.
- Oppenheimer M., Glavovic B., Hinkel J., van de Wal R., Magnan A. K., Abd-Elgawad A., Cai R., Cifuentes-Jara M., Deconto R. M., Ghosh T., Hay J., Isla F., Marzeion B., Meyssignac B. & Sebesvari Z., 2019. Chapter 4. Sea level rise and implications for low lying islands, coasts and communities. In: Pörtner H.-O., Roberts D., Masson-Delmotte V. & Zhai P. (Eds.), *Special Report on Ocean and Cryosphere in a Changing Climate*. Geneva: Intergovernmental Panel on Climate Change.
- Possner A. & Caldeira K., 2017. Geophysical potential for wind energy over the open oceans. *Proceedings of the National Academy of Science U.S.A.* 114:11338-11343.
- Turrell W. R., 2019. Marine science within a net-zero emission statutory framework. *ICES Journal of Marine Science*, doi : 10.1093/icesjms/fsz164.