XX September 2018

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Dear Secretary Clüsener-Godt and Chairman Babin:

We write on behalf of the undersigned environmental justice and conservation organizations representing tens of millions of supporters across the world. We are deeply concerned about the harmful impacts on the critically endangered species and unique ecosystems of Quirimbas Biosphere Reserve, as well as the negative effects on local communities and their rights, as a result of the liquefied natural gas (LNG) development in the Cabo Delgado province in northern Mozambique. The exploration for and extraction of gas in this area will have devastating effects on the surrounding region, including Quirimbas, which the Man and the Biosphere Programme International Co-ordinating Council (MAB-ICC) recently added to the World Network of Biosphere Reserves.[1] The profoundly negative impacts of LNG development in northern Mozambique put the recently designated Quirimbas Biosphere at risk.

We urge UNESCO and the ICC to take steps to prevent the degradation and destruction of this important reserve and the species residing in and around it. Specifically, we urge the Secretariat, the ICC Advisory Committee, and the ICC to review the ongoing LNG development, proposed for completion in the early 2020s, and consider whether Quirimbas Biosphere Reserve continues to meet the Statutory Framework criteria. These criteria require that the Reserve be maintained to "be of significance for biological diversity conservation." Further, the designated "core area" of the Reserve must be "devoted to long-term protection," the "buffer zone" must be managed to only allow "activities compatible with" conservation like eco-tourism and research, and in the "outer transition area" only "sustainable resource management practices" may be allowed.[2] LNG development cannot be considered "sustainable resource management" and should not occur within any area designated as Biosphere Reserve, and development outside the Reserve will have

1 UNESCO, Press Release, Mozambique joins World Network of Biosphere Reserves, 25 July 2018, http://www.unesco.org/new/en/harare/about-this-office/single-view/news/mozambique_joins_world_network_of_biosphere_reserves/.
2 Seville Strategy and Statutory Framework of the World Network of Biosphere Reserves, Art. 4.

substantial negative impacts on the biodiversity and conservation potential for the Reserve itself. These issues and concerns should be made public and an inquiry into the impact of the natural gas opened.

The development of natural gas in northern Mozambique will have a huge impact on the local environment in Cabo Delgado. The sheer area of the project is massive; the subsea gas fields of one portion of the gas fields alone – known as Area 1 – is approximately 350 km² (not to mention the corresponding infrastructure and pipelines),[3] while the footprint of another portion – known as Area 4 – is 10,207 km².[4] Quirimbas National Park, which is encompassed within the Biosphere Reserve, lies almost immediately south of Area 1 of the gas development – only eight kilometers from Area 1's southern boundary.[5] The extraction, processing, and transportation of gas will require dredging, disposal of waste materials offshore and onshore, and the construction of subsea, near-shore, and on-shore structures and infrastructure that will have harmful effects on the nearby communities and ecosystems, including Quirimbas. The LNG development will cause habitat degradation, noise, and ship strikes and will force species, such as humpback and sei whales, to leave the area. The traffic to and from the extraction wells and the floating LNG processing plant will put the wildlife that surrounds and inhabits Quirimbas at risk. Moreover, if spills or gas accidents, which have become prevalent at energy extraction sites, occur, the impacts will be even more catastrophic.[6] Proponents of the project frankly acknowledge substantial short- and long-term impacts, including noise disturbance, habitat destruction, vessel strikes, and lighting impacts from the various aspects of the project, including offshore drilling, cutting trenches for pipelines and shipping channels, construction of the LNG facility and associated shipping terminal, and operation of the facility.[7]

Below, we outline urgent concerns pertaining to biodiversity in Quirimbas Biosphere Reserve, impacts of oil and gas exploration and development, LNG spill hazards, and impacts of climate change.

Biodiversity of Quirimbas Biosphere Reserve

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3 Impacto Projectos Estudos Ambientais & ERM, Environmental Impact Assessment (EIA) Report for the Liquefied Natural Gas Project in Cabo Delgado, ch. 4, sec. 4.2.2, p. 4-3 (Feb. 2014), http://www.mzlng.com/content/documents/MZLNG/EIA/Volume_I/English/Chapter_4-_LNG_Final_EIA_Sept_2014_Eng.pdf [hereinafter "ERM"].

4 Consultec – Consultores Associados, Lda., *Environmental Impact Assessment Process for the Floating Liquefied Natural Gas Project: Environmental Impact Study Final Report*, p. 43 (2015) [hereinafter "Consultec"].

5 ERM, Chapter 6: Baseline - Introduction and Geographical Context, pp. 6-43—6-45, http://www.mzlng.com/content/documents/MZLNG/EIA/Volume_I/English/Chapter_6-_LNG_Final_EIA_Sept_2014_Eng.pdf.

6 For an example of the types of harm caused by oil and gas drilling, see the Center for Biological Diversity and its partners' National Environmental Policy Act comments on a proposed oil and gas facility off Alaska. On file with the authors. While the Alaskan and Mozambique ecosystems are very different, the types of harm (GHG emissions, noise disturbance, risk of oil spill, etc.) are similar.

7 ERM, Mozambique LNG Environmental Impact Assessment, Chapter 11: Offshore and Near Shore Environmental Impact Assessment and Mitigation, http://www.mzlng.com/content/documents/MZLNG/EIA/Volume_II/English/Chapter_11-_LNG_Final_EIA_Sept_2014_Eng.pdf.

The coastline of eastern Africa, particularly the northern coast of Mozambique, is home to incredible biodiversity. Roughly 60 percent of eastern Africa's remaining mangrove forests are in Mozambique, providing excellent habitat and tremendous ecosystem services.[8] Northern Mozambique's coral reefs are also largely intact and are some of the most species-diverse coral reefs in the region, particularly in the Quirimbas Archipelago of Cabo Delgado Province where the natural gas development will occur.[9] The area's particularly productive sea grass beds also provide nursery grounds and foraging habitat for fish and turtles.[10] Recognizing these ecological attributes, as well as the area's cultural history, Mozambique proposed Quirimbas Archipelago for World Heritage designation.[11]

The Quirimbas National Park and surrounding area have a wide diversity of animals including whales, dolphins, turtles, sea birds, and fish, as the ICC recognized in designating the area as a Biosphere Reserve.[12] The International Union for Conservation of Nature (IUCN) considers a number of these species as imperiled, including sei whales; Indian yellow nosed albatross; and loggerhead, green, leatherback, and hawksbill turtles.[13] A number of fish and other species observed in the area are quite possibly new to science and, therefore, have not yet been taxonomically classified.[14] The endangered green and hawksbill sea turtles have been documented nesting on Vamizi, Rongui, and Macaloe islands, within and immediately south of gas development.[15] In addition, endangered humpback whales calve in the area and have been sighted within Palma Bay.[16] The project will destroy areas of pristine coral reefs, mangroves, and sea grass beds, as well as endangered plant species unique to this part of the world.[17] Fewer and fewer places in the world contain these ecosystems, so protecting Quirimbas National Park and its surroundings is more important than ever.

Impacts of Oil and Gas Exploration and Development

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8 M. Samoilys et al., *Resilience of Coastal Systems and Their Human Partners in the Western Indian Ocean.* Nairobi, Kenya: IUCN ESARO, WIOMSA, CORDIO and UNEP Nairobi Convention (2015).
9 *Id.*
10 *Id.*
11 UNESCO, The Quirimbas Archipelago, http://whc.unesco.org/en/tentativelists/5380/ (last visited 2 Aug 2018); UNESCO, International Coordinating Council of the Man and the Biosphere (MAB) Programme: Thirtieth Session, Palembang, South Sumatra Province, Indonesia, 23-28 July 2018, p. 8, item 65, http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/images/SC-18-CONF-230-8_New_BRs_Extensions_Modifications-EN.pdf.
12 Mozambique LNG EIA, Chap. 7 at 7-95, 7-32.
13 IUCN, Balaenoptera borealis, http://www.iucnredlist.org/details/2475/0; IUCN, Thalassarche carteri, http://www.iucnredlist.org/details/22728372/0; IUCN, Caretta caretta, http://www.iucnredlist.org/details/3897/0; IUCN, Chelonia mydas, http://www.iucnredlist.org/details/4615/0; IUCN, Dermochelys coriacea, www.iucnredlist.org/details/6494/0; IUCN, Eretmochelys imbricata http://www.iucnredlist.org/details/8005/0.
14 ERM, *Chapter 7: Environmental Baseline* (2014), http://www.erm.com/contentassets/9f1c634c714f419384baea6dcdb492bd/volume-1/chapter-7--lng-final-eia_sept-2014_eng.pdf.
15 *Id.* at ch. 7, at 7-96.
16 ERM, *Chapter 7: Environmental Baseline* (2014), http://www.erm.com/contentassets/9f1c634c714f419384baea6dcdb492bd/volume-1/chapter-7--lng-final-eia_sept-2014_eng.pdf.
17 IUCN, Ormocarpum schliebenii, http://www.iucnredlist.org/details/179265/0 (last visited 14 Aug. 2018).

Routine activities from oil and gas development cause negative impacts to wildlife, including vessel strikes, marine debris, water quality impacts, and destruction of habitat. The resulting significant increase in vessel traffic contributes to collisions with endangered whales, dugongs, and other transitory species, causing major wounds, which can be fatal.[18] Additionally, marine debris from discarded plastic used during offshore drilling and production harms listed whales and sea turtles by entangling them, causing injury or impaired mobility that can interfere with feeding and reproduction.

Oil and gas exploration and development activities that produce anthropogenic noise under water include seismic surveying, drilling and the discharge of toxic drilling sludge, offshore structure emplacement, offshore structure removal, and production-related activities, including ship and helicopter activity for providing supplies to the drilling rigs and platforms.[19] Although all of these activities impact marine life, seismic surveys used to detect oil and gas deposits underneath the ocean floor are particularly harmful. For offshore exploration, the oil and gas industry typically rely on arrays of airguns that are towed behind ships and release intense impulses of compressed air into the water about once every 10-12 seconds. Although airguns are vertically oriented within the water column, horizontal propagation is so significant as to make them one of the leading contributors to low-frequency ambient noise, reaching thousands of miles from any given survey.[20] A large seismic airgun array can produce effective peak pressures of sound higher than those of virtually any other human-made source save explosives.[21] Noise from a single seismic survey can affect a region of about 300,000 km^2 and raise noise levels two orders of magnitude higher than normal continuously for days.[22] The highest energy levels produced by seismic airguns fall within the frequency range from 10 to 200 Hz and can extend up into the 1-10 kHz band.[23]

It is well established that the high intensity pulses produced by seismic airguns can cause a range of impacts on marine mammals, fish, and other marine life, including abandonment of important habitat, masking of important natural sounds, disruption of vital behaviors essential to foraging and breeding, increased stress, temporary or permanent hearing loss, loss of biological diversity, and injuries and mortalities.[24] For cetaceans, which are particularly reliant on sound, lethal and sublethal impacts are well-documented. Strandings and mortalities, especially of beaked whales, have been linked to seismic surveys and are thought to have caused prolonged and serious

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18 *E.g.*, Knowlton, A.R., S.D. Kraus, D.F. Meek, & M.L. Mooney-Seus. 1997. *Shipping/right whale workshop*, New England Aquarium, Aquatic Forum Series, Report 97-3 (northern right whale); Fertl, D. 1994. *Oxxurrence, movements, and behavior of bottlenose dolphins (Tursiops truncates) in association with the shrimp fishery in Galveston Bay, Texas*. M. Sc. Thesis, Texas A&M University, College Station (bottlenose dolphin).

19 Ocean Studies Board. 2003. Ocean Noise and Marine Mammals. Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals. The National Academies Press, Washington, D.C., available at http://www.nap.edu/openbook.php?isbn=0309085365.

20 Nieukirk, S. L., K. M. Stafford, D. K. Mellinger, R. P. Dziak, and C. G. Fox. 2004. Low-frequency whale and seismic airgun sounds recorded in mid-Atlantic Ocean. Journal of Acoustical Society of America 115:1832-1843.

21 MMS. 2004. Geological and Geophysical Exploration for Mineral Resources on the Gulf of Mexico Outer Continental Shelf. U.S. Department of the Interior, Minerals Management Service, MMS 2004-054; Ocean Studies Board, *supra* note 13.

22 Weilgart, L. S. 2007. The impacts of anthropogenic noise on cetaceans and implications for management. Canadian Journal Of Zoology 85:1091-1116.

23 Ocean Studies Board, *supra* note 13.

24 Weilgart, *supra* note 16.

population impacts in at least one case.[25] Impacts from seismic surveys include cessation of singing by 250 male fin whales for months; displacement of western gray whales off Sakhalin Island, Russia, from their primary feeding area, returning only days after seismic activity ceased; avoidance of active arrays by odontocetes, killer whales, and mysticetes in United Kingdom waters (including reduced feeding, faster swimming by smaller odontocetes, and increased surface activity by mysticetes); and avoidance of seismic airgun noise by bowheads, humpbacks, and harbor porpoises.[26]

Studies indicate that seismic surveys can alter behavior and cause injury to fish and invertebrate species.[27] Seismic airguns damaged fish ears at distances of 500 meters to several kilometers from seismic surveys, with no recovery apparent 58 days after exposure.[28] Even under moderate levels of noise exposure, some fish experience temporary hearing loss, with fish occasionally requiring weeks to recover their hearing.[29] Noise has been shown to produce a stress response and behavioral reactions in some fish, including loss of coherence, dropping to deeper depths, milling in compact schools, ‘‘freezing,’’ and becoming more active.[30] For example, fish have been reported to flee from seismic shooting areas, as inferred from decreased catch rates for both long lines and trawler fisheries.[31] Reduced catch rates of 40 to 80 percent and decreased abundance have been reported near seismic surveys in many fish species.[32] In addition, invertebrates – giant squid, snow crabs, and brown shrimp – were observed to have damage to organs and reproductive development when exposed to seismic and other noises.[33]

LNG Spill Hazards

A spill of LNG can result in a fire or an explosion since natural gas is highly flammable.[34] The thermal radiation, *i.e.*, heat, from a LNG pool fire can be felt a far distance from the pool itself,[35] presenting a danger to the marine species in Quirimbas National Park. The temperatures of these fires could reach 1300 to 1600º Celsius.[36] This intense heat can harm animals and ecosystems even when they are a considerable distance from the fire itself.[37] Compared to oil and gasoline

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25 *Id.*
26 *Id.*
27 MMS, *supra* note 15; Weilgart, *supra* note 16.
28 Weilgart, *supra* note 16.
29 *Id.*
30 *Id.*
31 Slabbekoorn, H., N. Bouton, I. van Opzeeland, A. Coers, C. ten Cate, and A. N. Popper. 2010. A noisy spring: the impact of globally rising underwater sound levels on fish. Trends in Ecology and Evolution doi:10.1016/j.tree.2010.04.005.
32 Weilgart, *supra* note 16.
33 *Id.*
34 Paul W. Parfomak & Adam S. Vann, Congressional Research Service, Liquefied Natural Gas (LNG) Import Terminals: Siting, Safety, and Regulation, Order Code RL32205, p. CRS-5 (May 2008), https://www.everycrsreport.com/files/20080515_RL32205_10562b6357b579c66fe91128b4e18091fed0425a.pdf.
35 U.S. Government Accountability Office, *Public Safety Consequences of a Terrorist Attack on a Tanker Carrying Liquefied Natural Gas Need Clarification*, GAO-07-316, p. 30 (Feb. 2007), https://www.gao.gov/assets/260/256821.pdf.
36 U.S. Department of Energy, Liquefied Natural Gas Safety Research: Report to Congress, p.6 (May 2012), https://www.energy.gov/sites/prod/files/2013/03/f0/DOE_LNG_Safety_Research_Report_To_Congre.pdf.
37 Parfomak & Vann, *supra* note 30 at CRS-6.

fires, LNG fires reach higher temperatures,[38] have a higher burn rate,[39] and produce taller flames with less smoke.[40] Smoke would normally act as a thermal shield, absorbing a significant portion of the radiant heat emissions. For all of these reasons, the heat from LNG pool fires is felt further away than oil and gasoline fires. No method exists to put out these fires; the only way for them to stop burning is for all of the LNG to be consumed.[41]

Even if an LNG pool fire does not form, the creation of flammable vapor clouds can result in other harms. LNG vapor clouds can reduce the concentration of oxygen in the surrounding air, which can asphyxiate species near or inside of them.[42] These vapor clouds can drift "some distance" from the source of the LNG pool,[43] which would most likely intrude upon the buffer and transition zones, if not Quirimbas National Park itself. In addition, since LNG has to be kept at very cold temperatures, the cold LNG vapors can frost or freeze the lung tissues when animals breathe them.[44]

Exacerbating Climate Change

Oil and gas production results in significant greenhouse gas emissions, which increase the impacts of climate change and ocean acidification on species and ecosystems. Coral reefs are at risk of disappearing entirely due to increasing ocean temperatures and ocean acidification from increased levels of dissolved carbon dioxide.[45] In order to avoid truly catastrophic consequences of climate change, we must reduce greenhouse gas emissions by, among other things, not extracting more fossil fuels, such as the LNG in northern Mozambique. The 0.7°C surface temperature rise that has occurred since the pre-industrial era has been linked to the increased frequency and severity of mass coral bleaching events.[46]

As the world's oceans absorb unprecedented levels of carbon dioxide from the atmosphere, ocean surface waters have become 30 percent more acidic relative to preindustrial levels. Scientists predict that if carbon dioxide emissions continue unabated, seawater acidity will increase 100 to 150 percent by the end of the century.[47] One of the main impacts of ocean acidification is that it impairs the ability of many marine organisms to build protective calcium

38 *Id.*
39 Anay Luketa, Recommendations on the Prediction of Thermal Hazard Distances from Large Liquefied Natural Gas Pool Fires on Water for Solid Flame Models, p. 17 (2011) https://prod.sandia.gov/techlib-noauth/access-control.cgi/2011/110495.pdf.
40 *Id.* at 13.
41 Parfomak & Vann, *supra* note 30 at CRS-6.
42 Siu, Nathan, et al. Idaho National Engineering Laboratory, Qualitative Risk Assessment for an LNG Refueling Station and Review of Relevant Safety Issues, INEEL/EXT-97-00827, p. 62 (1998), https://www.osti.gov/servlets/purl/1186866.
43 Parfomak & Vann, *supra* note 30 at CRS-6
44 *Id.* at p. 63.
45 Donner, S. D. 2009. Coping with commitment: projected thermal stress on coral reefs under different future scenarios. PLoS One 4:e5712; Veron, J. E. N., O. Hoegh-Guldberg, T. M. Lenton, J. M. Lough, D. O. Obura, P. Pearce-Kelly, C. R. C. Sheppard, M. Spalding, M. G. Stafford-Smith, and A. D. Rogers. 2009. The coral reef crisis: The critical importance of <350 ppm CO2. Marine Pollution Bulletin, doi:10.1016/j.marpolbul.2009.09.009.
46 Hughes, T. et al. 2017: Global warming and recurrent mass bleaching of corals. Nature, 543, 373–377, https://www.nature.com/articles/nature21707; Hughes, T. et al. 2018: Spatial and temporal patterns of mass bleaching of corals in the Anthropocene. Science, 359, 80–83, http://science.sciencemag.org/content/359/6371/80; Donner, *supra* note 28.

carbonate shells and skeletons because carbonate minerals become less available.[48] Nearly all calcifying organisms studied, including species from the major marine calcifying groups and plankton at the base of the marine food web, have shown reduced calcification in response to elevated carbon dioxide in laboratory experiments.[49] In field studies, slower growth rates have already been observed in some corals,[50] and many corals could be lost within a few decades due to global warming and acidification.[51]

Ocean acidification also disrupts metabolism and other biological functions in marine life. Changes in the ocean's carbon dioxide concentration result in accumulation of carbon dioxide in the tissues and fluids of fish and other marine animals and increased acidity in body fluids. These impacts can cause a variety of problems for marine animals, including difficulty with acid-base regulation, metabolic activity, respiration, and ion exchange, leading to impairment of growth and higher mortality rates.[52] In fish, high concentrations of carbon dioxide in seawater can lead to cardiac failure and mortality.[53] At lower concentrations, sublethal effects can seriously compromise the fitness of fish.[54] Juvenile and larval stages of fish were found to be even more vulnerable.[55] Some studies show that juvenile marine organisms are particularly susceptible to ocean acidification.[56] In conditions simulating future seawater with elevated carbon dioxide, larval clownfish lost their detection and homing abilities to find suitable habitat.[57] Moreover, ocean acidification decreases the sound absorption of seawater, causing sounds to travel further with potential impacts on marine life that may be sensitive to noise from vessel traffic, seismic surveys, and other sources of noise pollution.[58]

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47 Orr, J. C., et al.. 2005. Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. Nature 437:681-686.

48 Feely, R. A., et al. 2009. Ocean acidification: present conditions and future changes in a high-CO2 world. Oceanography 22:36-47; Orr, *supra* note 44; Fabry, V. J., et al. 2008. Impacts of ocean acidification on marine fauna and ecosystem processes. ICES Journal of Marine Sciences 65:414-432; Feely, R. A.,et al. 2004. Impact of anthropogenic CO2 on the CaCO3 system in the oceans. Science 305:362-366.

49 Kleypas, J. A., et al. 2006. Impacts of ocean acidification on coral reefs and other marine calcifiers: A guide to future research. Report of a workshop held 18–20 April 2005, St. Petersburg, FL, sponsored by NSF, NOAA, and the U.S. Geological Survey, 88 pp; Fabry, *supra* note 30.

50 De'ath, G., J. et al. 2009. Declining coral calcification on the Great Barrier Reef. Science 323:116-119.

51 Hoegh-Guldberg, O., et al. 2007. Coral reefs under rapid climate change and ocean acidification. Science 318:1737-1742; Veron, J. E. N. et al. 2009. The coral reef crisis: The critical importance of <350 ppm CO2. Marine Pollution Bulletin, doi:10.1016/j.marpolbul.2009.09.009..

52 Ishimatsu, A., at al. 2004. Effects of CO2 on marine fish: Larvae and adults. Journal of Oceanography 60:731-741; Pörtner, H. O., et al. 2004. Biological impact of elevated ocean CO2 concentrations: Lessons from animal physiology and earth history. Journal of Oceanography 60:705-718; Royal Society. 2005. Ocean acidification due to increasing atmospheric carbon dioxide. Policy document 12/05. Available at www.royalsoc.ac.uk. The Royal Society, London, UK.

53 Ishimatsu et al., *supra* note 33.

54 *Id.*

55 *Id.*

56 Ishimatsu et al., *supra* note 33; Kurihara, H., and Y. Shirayama. 2004. Effects of increased atmospheric CO2 on sea urchin early development. Marine Ecology Progress Series 274:161-169.

57 Munday, P. L. et al. 2009. Ocean acidification impairs olfactory discrimination and homing ability of a marine fish. Proceedings of the National Academy of Sciences of the United States of America 106:1848-1852.

58 Hester, K. C. et al. 2008. Unanticipated consequences of ocean acidification: a noisier ocean at lower pH. Geophysical Research Letters 35, L19601, doi:10.1029/2008GL034913; Brewer, P. G., and K. C. Hester. 2009. Ocean acidification and the increasing transparency of the ocean to low-frequency sound. Oceanography 22:86-93.

Impacts on Local Communities

The gas projects will have a devastating impact on the surrounding local communities. Contaminated water and soil will lead to illnesses, which the companies have themselves admitted in their environmental impact assessments. The decrease in marine life means that fishing, the major means of livelihood for the some of the surrounding villages, will no longer be possible. Several communities will be relocated to areas that are far from farmland and the sea, and will lose the land they have cultivated for centuries. There has been little to no proper consultation by the companies and assessors with the communities, and the consultation that has happened is compromised by internal corruption and hostility create by the companies themselves. As Indigenous People is one of UNESCO's priority areas, it is imperative that the irreversible effects on the communities be strongly considered.

We urge the Secretariat and the ICC to take steps to prevent the destruction of the recently designated Quirimbas Biosphere Reserve and the species residing in and around it as a result of the LNG development in northern Mozambique. We appreciate you taking the time to review our comments and request a response by XX October.

Sincerely,

Anabela Lemos
Justiçia Ambiental!/Friends of the Earth Mozambique

Kate DeAngelis
Friends of the Earth United States

Both ENDS

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