

## 5. Financing

### Major Recommendations:

#### 5.0 Adaptation and mitigation efforts in coastal and SIDS countries /communities should receive sufficient funding, through:

**5.1 Thorough examination of assessments of costs of adaptation, mitigation, and displacement (existing assessments are often inadequate, for example, do not account for ecosystem services)**

**5.2 Development of a financial tracking mechanism to report on financial flows to support climate change efforts related to oceans and coasts**

**5.3 Earmarked funds in global public finance mechanisms to support adaptation and mitigation in coastal areas and SIDS**

**5.4 Earmarked 10% of public and investments in coastal infrastructure for coastal habitat protection and restoration)**

**5.5 Develop a financial tracking mechanism to report on financial flows to support climate change efforts related to oceans and coasts and SIDS**

**5.6 Earmark funds in global public finance mechanisms to support adaptation and mitigation in coastal areas and SIDS**

### Financing Adaptation to a Changing Ocean

Previous sections have emphasized the central role of the ocean in human economic and social well-being, and the projected impacts on it as a result of climate-related drivers in various global scenarios for rising greenhouse gas emissions, including sea level rise and storm surge, and ocean warming and acidification, among others. In addition to these climate-related drivers of change, the ocean is already experiencing impacts from a number of other human-related drivers. The United Nations estimates that already as much as 40% of the global ocean is heavily affected by human activities,<sup>200</sup> and earlier in

2015 the G7 Science Academies issued a statement warning that these activities are leading to changes that will significantly affect human economic and social well-being.<sup>201</sup> These changes include:

- *Depletion of fish stocks* (29% of the world's assessed ocean fisheries are considered biologically overfished—up from 10% in 1970);<sup>202</sup>
- *Loss/conversion of coastal natural habitats* (the world has lost 20% of sea grass and mangrove habitats since the 1970s and 1980s respectively, and coral reefs have declined by 38% since 1980); and
- *Pollution* into ocean waters (some 80% of pollution entering the ocean comes in the form of excess nutrients from land-based sources such as agriculture and untreated sewage,<sup>203</sup> while an estimated 4.8 to 12.7 million tons of plastic entered the ocean in 2010, with an estimated total natural capital cost of US\$13 billion/year).<sup>204</sup>

The cumulative impact of this combination of climate-related and other human-related drivers threatens the ability of the ocean to provide a range of services essential to the social and economic well-being of many communities and societies, notably those in developing coastal and island states. For example, some 3 billion people are estimated to depend on marine and coastal biodiversity for their livelihoods,<sup>205</sup> and seafood contributes over 16 percent of the animal protein consumed by the world's population—with 1 billion people in developing countries relying on this source of protein.<sup>206</sup> More broadly, a range of services are provided by the ocean—many of which are dependent upon the functioning of marine ecosystems—(See Box 3.1 in Part 3) leading to an annual 'gross marine product' of some \$2.5 trillion according to WWF.<sup>207</sup> In many cases these services could be greater with reduced stressors on ecosystems, for example the ocean's commercial fisheries could generate an estimated \$50 billion more in annual net economic benefits with reductions in fishing pressure.<sup>208</sup>

Given the importance of ocean ecosystems to human social and economic well-being, as well as the

impacts of both climate-driven and other human-driven changes to these systems, the description of adaptation costs and financing options in this section is organized as follows:

*Coastal Populations:* The costs of measures to help coastal populations and sectors adapt to climate-related impacts;

*Ecosystems:* The costs of measures to help ocean ecosystems adapt to climate-related impacts in order to continue to provide current services;

*Ocean adaptation costs compared to global adaptation costs:* Putting the known estimates for ocean adaptation costs into perspective of estimates for global adaptation costs; and

*Financing mechanisms for ocean, SIDS and coastal adaptation:* A brief summary of global public adaptation financing mechanisms that could help offset the costs of ocean adaptation, and emphasis on the potential gap that exists.

This division reflects the need to reduce the vulnerability of coastal populations to climate-related impacts, as well as the vulnerability of the ocean's ecosystems that support the global population. Ecosystem management—or reducing other human-related stressors on coastal and ocean ecosystems such as overfishing, loss/conversion of coastal natural habitats, pollution—is one of the key categories of approaches for reducing vulnerability and exposure and increasing adaptation to climate-related changes in the ocean.<sup>209</sup> As the IPCC states, climate-related impacts only add to the threats posed by overfishing and these other human-related stressors.<sup>210</sup> Essentially, reducing these stressors can both enhance adaptation and help achieve the Sustainable Development Goal 14 (SDG14): to conserve and sustainably use the oceans, seas and marine resources for sustainable development.<sup>211</sup> *As such, ocean adaptation—both of coastal populations and of ocean ecosystems—is tightly linked to meeting SDG14, and vice versa.*

Finally, these costs of adaptation should be considered in the context of the costs of climate mitigation. The latter are also difficult to measure and depend heavily on the costs associated with the baseline scenario. The most widely cited global mitigation cost estimate is the cumulative loss of 1%

+/-3% of global GDP by 2050, or 0.05% average annual global GDP.<sup>212</sup> Due to the uncertainties involved in measuring global mitigation costs, experts caution about putting much emphasis on the actual dollar values.<sup>213</sup> *There is a large cost associated with climate mitigation, and a healthy ocean can play a large role in climate mitigation by offsetting costs at least partially through blue carbon finance, biodiversity finance, other payments for ecosystem services, and other mechanisms.*

### **The Costs of Measures to help Coastal Populations Adapt to a Changing Ocean**

*Types of investments needed.* Without adaptation, hundreds of millions of people will be affected by coastal flooding and displaced by 2100.<sup>214</sup> Adapting to climate-driven increases in sea levels and storm surge will require various types of investments, classified in the IPCC's 5<sup>th</sup> Assessment Report as:

1. *Retreat:* allowing wetlands to migrate inland, shoreline setbacks, and managed realignment by, for example, breaching coastal defenses allowing the creation of an intertidal habitat;
2. *Accommodation:* increasing flexibility, flood proofing, flood-resistant agriculture, flood hazard mapping, the implementation of flood warning systems, or replacing armored with living shorelines; and
3. *Protection:* advancing or holding existing defense lines by means of different options such as land claim; beach and dune nourishment; the construction of artificial dunes and hard structures such as seawalls, sea dikes, and storm surge barriers; or removing invasive and restoring native species.<sup>215</sup>

Additionally, increasing attention has been given to community-based adaptation measures, and ecosystem-based adaptation, including protection and restoration of relevant coastal natural systems such as mangroves, oyster reefs, and salt marshes.<sup>216</sup> Finally, the above costs do not include the potentially significant costs to SIDS that could be associated with population displacement or even loss of territorial integrity and EEZ.<sup>217</sup>

Investments in reducing vulnerabilities in fisheries and aquaculture ecosystems and the communities

that depend on these will also be necessary. Targeted investments in understanding the vulnerability of food security to climate change and extreme weather events are needed to guide targeted adaptation actions ranging from climate proofing development and management plans to technical tools and processes to increase resilience throughout the food production supply chain.

*Estimated costs.* The full global cost of protection measures to help coastal populations adapt to sea level rise and storm surge have been estimated by various organizations, though with high levels of uncertainty.<sup>218</sup> These estimates have focused on protection of coastlines via dykes and beach nourishment, indicating annual investment and maintenance costs by 2100 on the order of:

1. US\$12 to 31 billion per year under the stringent mitigation scenario (increase in global mean surface temperature of 0.3 and 1.7 °C) and
2. US\$27 to 71 billion per year under the high emission scenario (increase in global mean surface temperature of 2.6 to 4.8 °C).<sup>219</sup>

Alternatively, coastal adaptation costs reported by IED (2009) are approximately US\$11 billion/year, of which US\$4 billion are for developing countries.<sup>220</sup>

### **The Costs of Helping the Ocean Adapt to a Changing Climate (*Ocean Warming and Acidification*)**

*Types of investments needed.* Reducing the vulnerability and preserving, restoring or increasing the resilience of ocean ecosystems is essential to sustaining the provision of many services upon which the global population depends. Because of ecological limits and in some cases low adaptive capacity, such natural systems are some of the most vulnerable “sectors” to climate-related impacts.<sup>221</sup> Marine ecosystems are no exception, given the projections for ocean warming and acidification, and the additional stresses on these systems—from overfishing, coastal habitat loss/degradation and pollution—only increase their vulnerability.

Coral reef ecosystems are the most vulnerable marine ecosystem, with little scope for adaptation.<sup>222</sup> Additionally, climate-related impacts on the distribution of marine species and biodiversity will

challenge sustained provision of fisheries productivity by the mid-21<sup>st</sup> century, as well as other marine ecosystem services—with tropical regions particularly vulnerable.<sup>223</sup> Ocean acidification also poses substantial risks to ocean ecosystems, with potentially detrimental consequences for fisheries and livelihoods.<sup>224</sup> Acidification acts together with other climate-related changes (e.g. warming) and with local changes such as pollution and eutrophication, and will be higher in areas where eutrophication is an issue.<sup>225</sup>

Investment options to directly help ocean ecosystems adapt to the impacts of warming and acidification are limited. Hence, ecosystem-based management of ocean resources and areas, in order to reduce these additional human-related stressors, should be a priority for financing ocean adaptation.<sup>226</sup> Such investments would also contribute directly towards achieving SDG 14. These types of investments include, among others:

- *Fisheries governance reform* to reduce overcapacity and effort on overexploited stocks and maintain fully exploited stocks at levels capable of supporting the maximum sustainable yield;
- *Integrated coastal and ocean management* to restore and/or protect critical natural habitats, as well as investments to conserve at least 10% of coastal and marine areas (notably coastal systems such as coral reefs, mangroves and seagrass beds, that support high levels of biodiversity); and
- *Reduction of land-based sources of pollution*, including increased wastewater treatment capacity in the coastal zone, reduction of excess nutrient use and runoff in agriculture systems and enhanced collection/prevention of marine debris.

*Estimated costs.* UNEP reports that the costs of measures to help coastal populations adapt to sea level rise and storm surge have been relatively well studied, but the costs of adaptation for natural systems (i.e. ecosystems) and the services they provide have not. This is certainly the case for ocean ecosystems, and the costs of reducing the other human-related stressors and achieving SDG14. At present, only very initial attempts have been made to indicate rough orders of magnitude of the costs, including:

- *Rebuilding marine fisheries*: estimated on the order of \$200 billion in present value;<sup>227</sup> and
- *Reducing land-based source of pollution to the ocean*: estimates on the order of US\$579 billion in investment, and some \$75 billion in annual expenditures.<sup>228</sup>

### Ocean Adaptation Costs in Comparison to Global Adaptation Costs

The global costs of adaptation have been estimated by a number of organizations (*Figure 5.1*),<sup>229</sup> most recently by the IPCC at some US\$70 to 100 billion annually by 2050. UNEP<sup>230</sup> found this estimate to be

likely far too low, suggesting estimates on the order of US\$300 billion annually by 2050. As mentioned previously, coastal protection costs alone have been estimated on a range of US\$12 to 71 billion per year by 2100, with high levels of uncertainty. This does not include ecosystem-based adaptation, notably reduction of other human-related stressors on ocean ecosystems per SDG14, such as overfishing, loss/conversion of natural coastal habitats and pollution. Initial estimates of very rough orders of magnitude suggest that the up-front investment costs to reduce these stressors could be on the order of hundreds of billions. Essentially, the costs for both coastal populations and ocean ecosystems to maintain current services may be on the order of at least tens of billions annually by 2050.

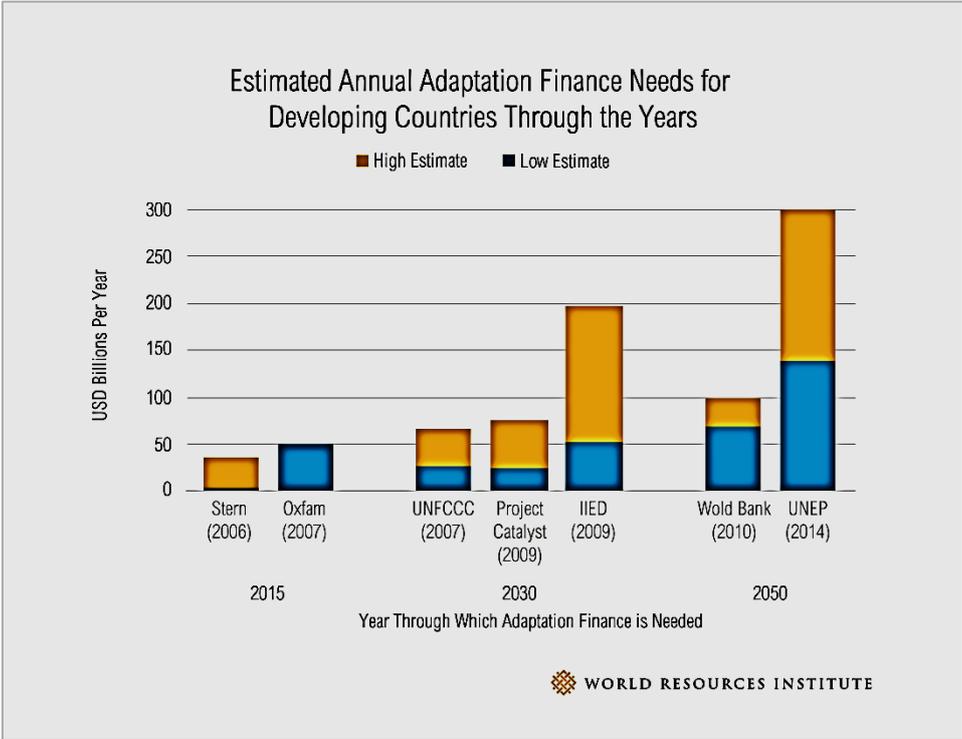


Figure 5.1. Global adaptation costs in the literature. Source: WRI (2015)<sup>231</sup>

### Financing Mechanisms for Ocean Adaptation

Finance for adaptation includes both public and private sources, with the former classified by UNEP as:

- Development finance institutions (including bi-lateral, multi-lateral and national institutions),
- Governments (through bilateral official development assistance contributions), and
- Climate Funds targeting adaptation.<sup>232</sup>

The various development finance mechanisms and climate funds that form available sources of public finance for the costs of adaptation have been described in the literature.<sup>233</sup> *Table 5.1* shows the most widely known and discussed climate finance mechanisms that can currently be drawn upon to fund adaptation, and in some cases mitigation, projects.

Table 5.1. Climate-Related Public Finance Mechanisms within the UNFCCC and Regional Development Banks

Name	Description	Funds available or allocated	Eligible ocean-related activities (including mitigation)
<i>GEF Trust Fund</i>	Finances adaptation projects under a specific Climate Change Focal Area (FA) for adaptation. The Strategic Priority on Adaptation (SPA), established in 2004 as a \$50 million allocation inside of the GEF Trust Fund, designed to support pilot and demonstration adaptation projects that provide real benefits and can be integrated into national policies and sustainable development planning. <sup>234</sup> SPA funding was accessible to all countries eligible for GEF funding. The SPA portfolio is now complete with 26 projects and \$649 million leveraged in co-financing.	Available (2014-18): \$3 billion <sup>235,236</sup> with an expected US\$30 billion being leveraged from other sources	Biodiversity, climate adaptation, chemical, international waters, land degradation, sustainable forest management / REDD+,  Can also finance mitigation (e.g. blue carbon)
<i>GEF Special Climate Change Fund</i>	Finances programs relating to adaptation, (capacity-building, technology transfer, and economic diversification) for all countries. Within these categories, the SCCF has two active funding windows: the Adaptation window (SCCF-A) and Technology Transfer window (SCCF-B).	Available (Pledged amount): \$227.5 million as of 2011 <sup>237</sup>	Capacity-building, adaptation, technology transfer, coastal zone and disaster risk management, enhancing the resilience of water resources management.
<i>GEF Least Developed Countries Fund</i>	Activities supported under this GEF operated fund include preparing and implementing NAPAs to identify the immediate needs of LDCs to adapt to climate change. LDCF grants are awarded to adaptation projects that address high-priority areas identified in the approved, country-specific NAPA.	Available (Pledged amount): \$420.8 million as of 2011 <sup>238</sup>	Natural resources, coastal zone, and water resources management
<i>Green Climate Fund</i>	A mechanism to assist the developing countries in adaptation (and mitigation) practices to counter climate change. Supports projects, programs, policies and other activities in developing countries and will aim for a 50:50 balance between mitigation and adaptation over time.	Available (to date): \$10.2 billion, <sup>239</sup> with \$100 billion per year pledged by 2020 as the target. <sup>240</sup>	Increasing the resilience of ecosystems such as wetlands, and communities, scaling up the use of modernized climate information and early warning systems  Can also finance mitigation (e.g. blue carbon)

<i>Adaptation Fund</i>	Finances practical adaptation projects and programs in developing countries and support capacity-building activities.	Available (allocated): \$318 million <sup>241</sup>	Water resources and land management, agriculture, health, infrastructure development, fragile ecosystems; Supporting capacity building for preventive measures, planning, preparedness and management of disasters
<i>African Development Bank (DB) climate change funds (CCF)</i>	Helps with adaptation by providing funding for 'climate finance readiness' projects in individual countries.	Available (2012): \$523 million <sup>242</sup>	Can also finance mitigation (e.g. blue carbon)
<i>Asian Development Bank (DB) climate change funds (CCF)</i>	Resources get pooled within the Bank to address climate change through technical assistance and grant components of investment projects.	Available (Allocated as of 2012): \$50 million <sup>243</sup>	Can also finance mitigation (e.g. blue carbon)

Table 5.1 illustrates public finance mechanisms available for at least a portion of the types of investments discussed previously for ocean adaptation, with a current total available of just under US\$10 billion (assuming only half of the current funding in the Green Climate Fund is available for adaptation), and an additional US\$80 billion per year pledged to the Green Climate Fund by 2020. These funds are not limited to ocean adaptation, but all global adaptation financing needs in developing countries. According to UNEP, the global amount of public finance committed to activities with explicit adaptation objectives ranged between US\$23 billion and \$26 billion in 2012 – 2013, of which 90% was invested in developing countries and a small percentage was invested towards coastal adaptation (see Figure 5.2 below).<sup>244</sup>

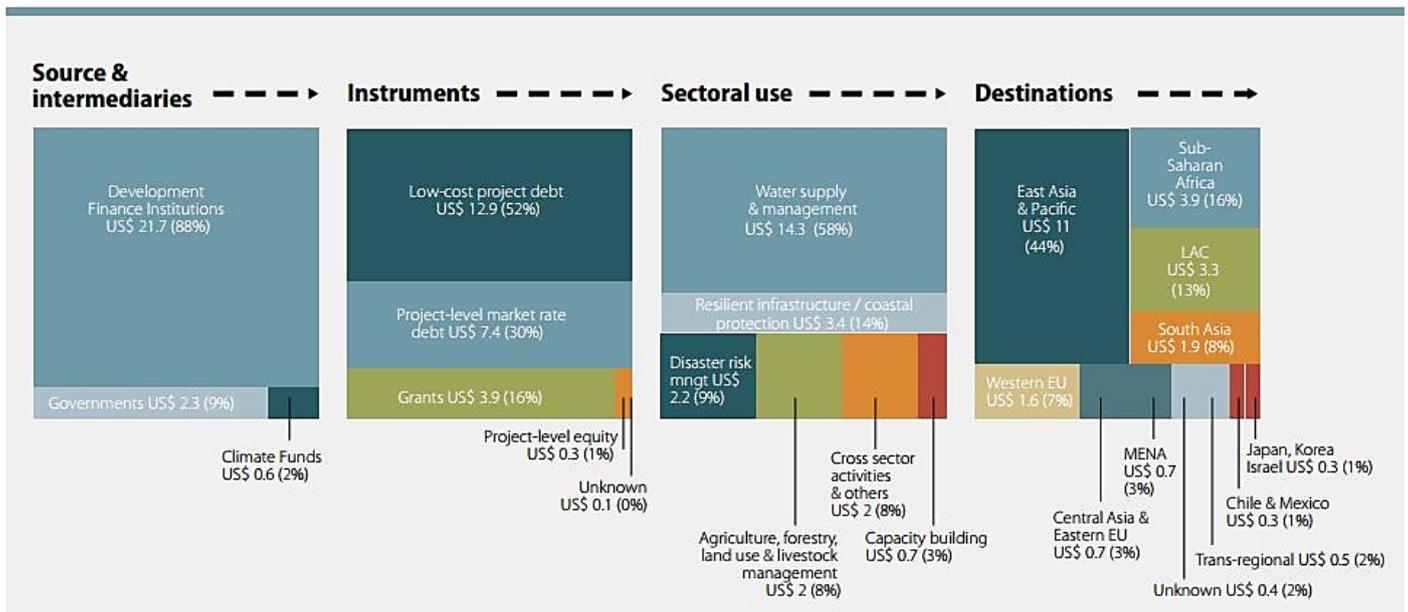


Figure 5.2. Breakdown of 2012/2013 Public Adaptation Finance Commitments in US\$ billions at current prices and percentage of total  
Source: UNEP (2014)

### Some Options to Fill the Ocean Adaptation Finance Gap

Given the high up-front global investment costs to implement coastal and marine ecosystem-based adaptation measures and other investments to reduce additional human-related stressors on the ocean (e.g. overfishing, loss/conversion of natural coastal habitats, pollution) and improve ecosystem and human well-being to achieve the SDG14, a case could be made for a global public financing mechanism targeted towards this objective.

Currently there is no *global public financing mechanism* for the ocean. The Global Environment Facility has an International Waters Program that provides some US\$450 million over a 4-year cycle to developing countries for the additional costs of measures that have global environmental benefits in either transboundary ocean waters and resources, or transboundary watersheds and lakes.<sup>245</sup> The World Bank has an active or cumulative portfolio of investments with potentially positive impacts on

ocean ecosystems on the order of US\$6.4 billion, including US\$1 billion targeted to sustainable fisheries and aquaculture, and another US\$5.4 billion for coastal wastewater treatment, watershed management and other activities that could help reduce pollution.<sup>246</sup> However, these levels of public finance are likely significantly below what would be needed to achieve SDG14 and ecosystem-based ocean adaptation.

Yet creating a new global financial mechanism, such as to finance ocean adaptation, is a labor-intensive process, generally requiring multi-lateral agreement on the objectives and governance of the fund, designation of a trustee, and robust procedures for disbursing, tracking and supporting the use of the funds according to internationally-agreed standards.

For this reason, it may be more feasible to ensure that some portion of existing mechanisms are available and dedicated to finance ocean adaptation, such as the Green Climate Fund. Additionally, The Nature

Conservancy has proposed a goal of shifting 10% of the estimated trillions in annual global coastal ‘grey’ infrastructure investment—US\$10 billion by 2020—towards financing coastal ecosystem protection and restoration: “green” or “blue” infrastructure (see Box 3.1). States (and/or existing global financial mechanisms and development banks) undertaking this commitment would need not transfer funds to a separate entity, but rather make investments directly and ‘tag’ them for monitoring purposes.

### ***Private Sector Involvement***

In the absence of a global public finance mechanism for ocean ecosystems that could support both adaptation and achieving SDG14, *potential private sector initiatives* are being proposed. For example, the Ocean Recovery Alliance has proposed an ‘*Ocean Appreciation Toll*’ as a voluntary mechanism for global importers/buyers who use the ocean to ship their products. The global shipping industry would be the channel for contributions, but the buyers/importers would make the payments to support ecosystem-based management.<sup>247</sup> The mechanism would function similar to a toll for the use of roads, set at a level intending to have negligible impact on shipping rates for buyers, but nonetheless generating significant total annual investment: US\$2 for every 20-foot container or equivalent to be paid by the buyers and collected at the point of insurance payment or port reception. Given that in 2013 some 650 million 20-foot container shipments took place, the toll would generate funds on the order of over US\$1 billion annually for enhancement or restoration of ocean ecosystem functions—towards both adaptation to climate-related drivers and achievement of SDG14.

A strong commitment to engaging and scaling up private investment into ocean adaptation and mitigation could be a significant boon, and there are already exemplary efforts being made in this area. The progress made by the Climate Bonds Initiative and the recent launch of the Coalition for Private Finance in Conservation both indicate that there is a serious interest in this type of funding which must be fully utilized. Public-private “blue finance” partnerships for coastal adaptation and related ocean infrastructure could be designed for multiple stakeholders to address climate challenges.

A new Ocean Sustainability Bank could then be funded from multiple sources, including the Green

Climate Fund and private sources. It could function as a hub for knowledge, debt, equity, and grant finance and as a lead institution to structure projects. This creation of this type of organization has been endorsed by a number of relevant partners, and the rapid growth of both the European Bank for Reconstruction and Development (EBRD) and the Asian Infrastructure Investment Bank (AIIB) indicate that there is growing acknowledgment of the magnitude of financial effort needed to address climate challenges.<sup>248</sup>

Collection and deployment of funds could be managed as a global trusteeship and disbursed to developing coastal and island countries and high biodiversity/high vulnerability ocean ecosystems according to agreed criteria and subject to performance monitoring and audits. In the absence of global public finance mechanisms targeted specifically towards ecosystem-based management and conservation of the ocean, such initiatives may become more and more feasible as a means to fill the funding gap for the costs of transitioning to sustainable fisheries and aquaculture, coastal natural habitat loss/conversion, pollution and other ecosystem-based ocean adaptation measures. Successful ocean finance can be achieved through a collaborative combination of earmarked funds, strong project planning and coordination, and innovation within marine technology development and transfer.

### **Conclusion**

#### ***The Estimated Costs of Ocean Adaptation***

Coastal protection costs alone have been estimated on a range of US\$12 to 71 billion per year by 2100, with high levels of uncertainty, and additionally a number of other ecosystem-based adaptation measures may be needed to reduce human-related stressors on ocean ecosystems and help meet SDG14 in the short term. Given the likely costs of adaptation for coastal populations and sectors, as well as the costs of reducing other human-related stressors on ocean ecosystems such as overfishing, habitat loss and pollution, the costs of ocean adaptation more broadly may be on the order of at least tens of billions annually by 2050.

#### ***Public Financing Mechanisms Available***

There is currently just under US\$10 billion estimated to be available (assuming only half of the current

funding in the Green Climate Fund is available for adaptation), and an additional US\$80 billion per year pledged to the Green Climate Fund by 2020. According to UNEP, the global amount of public finance committed to activities with explicit adaptation objectives ranged between US\$23 billion and \$26 billion in 2012-2013, of which 90% was invested in developing countries and a small percentage was invested towards coastal adaptation.

***Recommendations Going Forward:***

- *Dedicated windows or earmarked funds from existing public finance:* Proposals have emerged to earmark some of the funds in global public finance mechanisms, or general coastal infrastructure funding, for investment in ocean adaptation—e.g. 10% of investment in ‘grey’ coastal infrastructure to be directed towards coastal habitat protection and restoration.

- *Private sector-led initiatives.* Similarly, private-sector initiatives are being proposed as voluntary mechanisms to generate funding for ocean adaptation, such as an ‘ocean toll’ on shipping.
- *Tracking investment in ocean adaptation within the UNFCCC.* In all cases, there is currently little monitoring or tracking infrastructure in place, by which to establish a baseline for public and private investment in ocean adaptation as defined here, nor to track incremental investments over time. Certainly in the case of the public finance mechanisms within the UNFCCC that are shown in Table 5.1, expenditures could be tagged for ocean/coastal adaptation to start to monitor the level of investment, particularly in developing coastal and island states. This could include for example, tracking National Adaptation Programs of Action (NAP) and Intended Nationally Determined Contributions (INDCs) on ocean adaptation projects and implementation.