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Sharing the benefits of sustainable fisheries: from global to local legal approaches to marine ecosystem services for poverty alleviation (Science – Policy Analysis)

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Sharing the benefits of sustainable fisheries: from global to local legal approaches to marine ecosystem services for poverty alleviation

Science - Policy Working Paper

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1. Introduction

A. Objectives of the marine benefits project

The Marine Benefits project is a one-year blue skies inter-disciplinary research project aiming to investigate how our current understanding of marine ecosystem dynamics and associated ecosystem services can be translated into policy and law in ways that help ensure fishing practices provide long-term livelihood benefits to the poor. Our framing concepts are the ecosystem approach[1] and the international legal concept of fair and equitable benefit-sharing.[2] Benefit-sharing is a component of the ecosystem approach that calls for rewarding stakeholders that are responsible for the management and restoration of ecosystem functions, based on valuations of ecosystem services, the removal of perverse incentives, and capacity-building.[3] Benefit-sharing is also increasingly used in the international human rights context.[4] The legal concept of benefit-sharing provides a useful lens to connect different sources of inequity in the regulation and management of marine governance constraints and opportunities for developing States (inter-State dimension) and those for small-scale fishing communities (intra-State dimension) to benefit from marine ecosystem services.

The rationale and genesis for this research is the reality that marine ecosystems and their fish stocks are under increasing pressure including from overfishing, habitat destruction and climate change. It is estimated that 28.8% of assessed fish are overfished, 61.3% fully fished, and only about 9% of stocks underfished.[5] It has been estimated that rebuilding overfished stocks and recovery of depleted marine ecosystems could increase production by 16.5 million tonnes and annual rent by US$32 billion.[6] The full implementation of the ecosystem approach could potentially provide an avenue for maintaining healthy stocks and rebuilding depleted ones. However, even if the above recovery was achieved, **a critical question is who would most benefit from maintained healthy and rebuilt stocks and ecosystems?**

Current governance regimes tend to favour the large-scale fishing sectors despite the important role of small-scale fisheries for national economies, food security, livelihoods and poverty reduction.[7] With roughly 260 million people employed in the small-scale fishing sector,[8] this sector plays key social and economic roles globally. It is important to note, that small-scale fisheries data (catch, employment, value, etc.) [is] often incomplete, especially in developing countries, which leads to **inaccurate assessments of fishing pressure and an underestimation of the sector's economic importance at global and national levels**.[9] It has been estimated that the small-scale sector contributes to roughly half of the global fish catches.[10]

Importantly, the sustainability of the small scale sector is directly dependent on healthy and productive marine ecosystems. In addition to economic benefits from rebuilding fish stocks

[1] Principles of the Ecosystem Approach, CBD Decision V/6 (2000), Annex section B, Operational Guidance, Annex section C, 2, para 9; CBD refinement and elaboration of the ecosystem approach, CBD Decision VII/11 (2004), Annex, table 1, Principle 12.5

[2] E Morgera, "An International Legal Concept of Fair and Equitable Benefit-Sharing" (July 20, 2015). Edinburgh School of Law Research Paper No. 2015/20. Available at SSRN: http://ssrn.com/abstract=2633939 or http://dx.doi.org/10.2139/ssrn.2633939.

[3] CBD Decision V/6, para 9.

[4] E Morgera (2015) supra note 2.

[5] FAO, *The State of World Fisheries and Aquaculture: Opportunities and Challenges* [SOFIA] (FAO 2014).

[6] Ibid.

[7] See C Bené, B Hersoug, EH Allison, "Not by Rent Alone: Analysing the Pro-Poor Functions of Small-Scale Fisheries in Developing Countries" (2010) 28 (3) Development Policy Review 325-358.

[8] LCL Teh, UR Sumaila, "Contribution of Marine Fisheries to Worldwide Employment" (2013) 14 Fish and Fisheries 77-88.

[9] ibid; See also M Barnes-Mauthe, KLL Oleson, B Zafindrasilivonona, "The Total Economic Value of Small-Scale Fisheries with a Characterization of Post-Landing Trends: An application in Madagascar with Global Relevance" (2013) 147 Fisheries Research 175-185; D Pauly and D Zeller. "Catch reconstructions reveal that global marine fisheries catches are higher than reported and declining." (2016) 7:10244 *Nature communications* 1-9, DOI: 10.1038/ncomms10244 |www.nature.com/naturecommunications

[10] HLPE/FAO, *Sustainable Fisheries and Aquaculture for Food Security and Nutrition: A Report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security*, (HLPE 2014); UN, *The First Integrated Marine Assessment: World Ocean Assessment I* [WOA] (UN, 2016), Ch 15.

and ecosystems, there could be **enhanced nutritional benefits addressing malnourishment, livelihood security and wellbeing.** It has been estimated that over 1.5 billion people obtain 20% of their animal protein needs from fish,[11] especially in developing countries; while 15% is provided to nearly 3 billion people globally.[12] To maintain and improve such benefits, fishery management regimes that are tangibly fair, equitable and sustainable are required. Thus, this project is intended to complement existing studies, by **exploring to what extent an ecosystem services (ES) concept, or framework, can assist in the implementation of the ecosystem approach, including fair and equitable benefit-sharing, in light of both international environmental and human rights law**.

This science-policy analysis aims at investigating the connections and misalignments between scientific approaches and evidence related to sustainable fisheries, including marine habitat protection, and policy debates, management approaches and scholarship in the context of ecosystem services. Within this broader context, the current analysis will first explore the science and policy of marine ecosystems and the "ecosystem approach", then relate this to the scholarship and policy on "ecosystem services", followed by connections with the literature on poverty alleviation.

A follow up analysis (forthcoming) will explore the legal questions identified in the first phase on the basis of international environmental and human rights law with respect to both inter- and intra-state dimensions of benefit-sharing.

We are thankful for the advice and input from our Advisors on the findings of this report and grateful for their involvement and guidance throughout this project.

2. The Science and Policy of Ecosystems

A. The role of marine biodiversity for ecosystem functioning and sustainable fisheries

This section aims at introducing ecosystem science, and to highlight the importance of biodiversity for marine ecosystem structure and function, and hence to a healthy, productive and more resilient environment, in particular for fishery dependent societies.

I. Nature and dynamics of marine ecosystems

Ecosystems are comprised of biotic (living organisms) and abiotic elements (physicochemical factors, such as temperature, salinity, and depth)[13] and the interactions between them. Thermodynamics explains energy transfer from one trophic level to another. For example, in the open ocean, only an estimated 10% of energy is transferred from one level to another, while 90% of the energy is lost in metabolic processes and as heat loss.[14] Trophic level studies are extremely important because they consider vital linkages among species. They demonstrate how certain species and/or an ecosystem's function might be affected by predation patterns and the depletion of other species.[15]

Longhurst suggests that marine ecosystems "(…) represent the response of those organisms that happen to have been present in each

[11] SM Garcia, AA Rosenberg, "Food Security and Marine Capture Fisheries: Characteristics, Trends, Drivers and Future Perspectives" (2010), 365 Phil. Trans. R. Soc. B 2869–2880.

[12] UR Sumaila et al, "Climate Change Impacts on the Biophysics and Economics of World Fisheries" (2011) 1 Nature Climate Change 449-456.

[13] J Caddy, G Sharp, "An Ecological Framework for Marine Fishery Investigations", *FAO Fisheries Technical Paper no. 283* (Rome: FAO, 1986).

[14] K Sverdrup, A Duxbury, A Duxbury, *An Introduction to the World's Oceans* (McGraw Hill, 2004).

[15] E Odum, *Ecology and Our Endangered Life-Support Systems* (Sinauer Associates, 1993).

ocean and coastal region; their degree of specific evolution within each region is determined by their ability to occupy a niche offered within the habitat, or the flexibility of their genetic response to new conditions."[16] This notion differs from the idea that "regional ecosystems are represented as an ideal state, and had evolved as the unique response to the characteristic exigencies of this or that region."[17]

While ecosystems comprise a high level of organisation to achieve a dynamic equilibrium and stability,[18] they are vulnerable to perturbation, generating instability.[19] Instability challenges an ecosystem's resilience. Tansley observed that in some cases, low levels of perturbation have resulted in the disintegration of an entire system. In light of this, **biodiversity and abundance have been highlighted as important elements for resilient marine ecosystems**.[20]

a) *Drivers of marine ecosystem degradation*

Current rates of marine biodiversity loss induced by human activities are unprecedented.[21] A recent study suggests that although defaunation has been less severe in the oceans than in terrestrial ecosystems, humans have considerably modified all major marine ecosystems.[22] This study also cautions that even though terrestrial defaunation started 50,000 years earlier than marine, "[m]arine extinction rates today look similar to the moderate levels of terrestrial extinction observed before the industrial revolution. Rates of extinction on land increased dramatically after this period, and we may now be sitting at the precipice of a similar extinction transition in the oceans."[23] The need to preserve diversity "in order to prevent irreversible ecological changes in the ecosystem of which the target fish species formed a part of" [24] has been highlighted in the literature since the 70s.[25]

The 2014 Living Planet Report suggests a decline of 39% in marine species populations between 1970 and 2010, with the sharpest declines observed in the tropics and the Southern ocean.[26] Further studies indicate an even sharper decline than previous thought of marine species of 49% between 1970 and 2012.[27] In terms of variability between different regions, numbers seem to have been increasing from previously depleted species in northern latitudes and falling in tropical and subtropical areas,[28] representing further challenges for developing countries and small-scale fishing communities that depend on these species for their livelihoods in these regions.

Marine species' decline can result in severe consequences for marine ecosystems and their services. Conversely, species' recovery contributes to healthier and more productive ecosystems, which provide essential services to humanity such as food, disaster risk reduction, oxygen provision. For instance, Roman et al identify important ecosystem services played by great whales, including in nutrient and carbon cycles.[29] The authors conclude that "[t]he continued recovery of great whales may help to buffer marine ecosystems from destabilizing stresses and could lead to higher rates of productivity in locations where whales aggregate to feed and give birth."[30] Other species groups also play a key role in ecosystem structure and function through regulating mecha-

[16] A Longhurst, *Mismanagement of Marine Fisheries* (Cambridge University Press, 2010), at 69.
[17] Ibid, at 69.
[18] A Tansley, "The Use and Abuse of Vegetation Concepts and Terms" (1935) 16 *Ecology* 284–307.
[19] Ibid.
[20] C Roberts, *The Ocean of Life: The Fate of Man and the Sea* (Viking, 2011).
[21] J Rocha, et al. "Marine Regime Shifts: Drivers and Impacts on Ecosystems Services" (2015), 370 (1659) *Philosophical Transactions of the Royal Society of London B: Biological Sciences* 20130273.
[22] DJ McCauley, et al. "Marine Defaunation: Animal Loss in the Global Ocean" (2015), 347 (6219) *Science* 1255641.
[23] ibid.
[24] A Longhurst (2010) supra note 16, at 11.
[25] Ibid, at 11.
[26] WWF, *Living Planet Report* (WWF, 2014).
[27] WWF/Zoological Society of London, *Living Blue Planet Report: species, habitats and human wellbeing* (WWF/ZSL, 2015).
[28] Ibid.
[29] J Roman et al, "Whales as Marine Ecosystem Engineers" (2014), 12 (7) Frontiers in Ecology and the Environment 377-385.
[30] Ibid, at 377.

nisms – a role played by keystone forage species such as capelin,[31] anchovies, sardines, menhaden, as well as top predators such as sharks, as well as benthic species such as corals and sponges.

b) *Role of fisheries in marine ecosystem change*

Jackson et al observed **the occurrence of major changes in coastal ecosystem structure and function are largely due to overfishing over the past centuries**, which resulted in a simplification of food webs in kelp systems, coral reefs and estuaries.[32]

The impacts of overfishing as a persistent perturbation on marine systems to such a degree that many formerly productive fishing areas are now a totally changed ecosystem.[33] Such perturbation can be also lead to a regime shift due to the extreme and fundamental nature of environmental change. As explained by Rocha et al, "[w]hile these [environmental] changes are often gradual, in some cases they can lead to regime shifts: persistent, substantial reorganizations of the structure and function of marine ecosystems."[34] Unsustainable fishing practices, which have continued to increase since the 1970s levels,[35] remain a great threat to marine biodiversity – the very supporting service of fisheries production. Furthermore, fishing pressures when combined with other stressors (e.g. warming waters, ocean acidification, pollution, etc) can result in even more significant adverse impacts on marine ecosystems. Cumulative, additive and synergistic impacts represent a bigger pressure on marine ecosystems than the sum of each one of these stressors.[36]

While the focus of this project is on small-scale fisheries, it is essential to understand the ecological legacy from industrial fisheries, which is proving to be one of the most significant pressures on marine ecosystems, and makes a compelling case for considering the **connections between ecosystem health and different types of fishery practices over time**. As suggested by Longhurst:

> "[This fishing industry revolution] included not only the expansion of industrial scale trawling to continental shelves and shallow banks in all oceans and at all latitudes, but also the expansion of pelagic fishing by purse-seine and long-lining for tuna and related species over the entire extent of the tropical and subtropical oceans – the largest living space on the planet – and the expansion of specialised trawling for shrimp from tropical to polar seas. This globalisation, initiated in the 1950s was largely completed prior to the end of the century; its most recent manifestation is the exploration of deep benthic habitats beyond the shelf edge and the development of trawling techniques for the fish that live there."[37]

Since the industrialization of fisheries and enhanced fleet capabilities and technologies (including refrigeration, and fish finding technologies), "fishing down the food web" (to lower trophic levels) and "fishing down the deep" (from coasts to deeper waters as resources get depleted) have become common practices,[38] as Pauly has suggested. This has led to changes in ecosystem composition and production patterns.[39]

When addressing provisioning services such as fish stocks, it is essential to consider the underlying ecological processes that support and regulates the provisioning of such a service. In order to do this, **an in-depth understanding of ecosystem integrity and function needs to be part of the science guiding fishery management.** Such is needed to foster a more holistic, spatial, multi-species and trophic-based approach to fisheries rather than the current focus on Individual stock assessments

[31] AD Buren et al, "Bottom-Up Regulation of Capelin, A Keystone Forage Species" (2014), 9 (2) PLOSOne 0087589.
[32] J Jackson et al, "Historical Overfishing and the Recent Collapse of Coastal Ecosystems" (2001) 293 Science 629-638.
[33] Ibid.
[34] Rocha et al (2015), supra note 21, at 1.
[35] FAO, SOFIA (2014), supra note 5.
[36] BS Halpern et al, "A Global Map of Human Impact on Marine Ecosystems" (2008), 319 (948) Science 948-952; Jackson et al (2001), supra note 32; CM Crain, K Kroeker, BS Halpern, "Interactive and Cumulative Effects of Multiple Human Stressors in Marine Systems" (2008), 11 (12) *Ecology letters* 1304-1315.
[37] Longhurst (2010), supra note 16, at 135.
[38] D Pauly, *5 Easy Pieces: The Impact of Fisheries on Marine Ecosystems* (Island Press, 2010).
[39] Ibid.

for the determination of sustainable catch levels. As highlighted by Longhurst:

> "Fishery science is usually perceived by its practitioners as being a critical and quantitative activity, deeply dependent on mathematical analysis … This blunt statement demonstrates what went wrong with the science: it forgot that it is heavily dependent on how other disciplines – biology and ecology – in which numerical predictions are quite often unsatisfactory. Consequently, there is a fundamental contradiction between the potential capability of fishery science and its stated task of making routine and quantitative predictions concerning the effects of specified levels of fishing on a stock of fish."[40]

With an increased understanding of biology, ecosystems and ecology, fisheries management can depart from a single species/single stocks approach (mechanist approach)[41] towards **a more holistic approach (an ecosystem approach) where interactions among species, (including humans)[42] and species and their habitats can be factored in in an attempt to achieve long-term sustainability of fish stocks, increased productivity and resilience of ecosystems.**

The ecosystem approach to fisheries[43] and ideally an ecosystem-based management more broadly (where other human activities are also considered), can help address the problems related to overfishing and habitat destruction as it applies tools, mechanisms and approaches to rebuild depleted ecosystems and maintain the health and productivity of marine ecosystems. **The ecosystem approach might be interpreted as an integrative tool for achieving sustainable development in all of its three dimensions (social, economic, and environmental)**. As noted McLeod et al,

> "...an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need. Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors."44

Given the non-linear characteristics of ecological systems, an ecosystem approach is a more adequate approach to fisheries than single-species management for achieving long-term sustainability. Such an integrated approach also provides the framework for including equity considerations in fisheries management (as per below) as opposed to traditional single-species management approaches. However, it is important to not underestimate the challenges associated with the implementation of an ecosystem approach due to scientific uncertainties, including with respect to cumulative effects of anthropogenic activities on marine ecosystems, including climate change and ocean acidification effects.

c) Additional complexity brought about by climate change

Fish stocks decline is aggravated by the increasing climate change and CO_2 concentration effects (i.e, warming waters, ocean-atmosphere circulation pattern changes, reduced pH, etc). Hence maintaining and/or re-building ecosystem resilience through enhanced governance and management, and a strategic reduction of anthropogenic impacts on vulnerable ecosystems is of utmost importance for long-term sustainability ecosystem services, including fishing resources, especially in face of cli-

[40] Longhurst (2010), supra note 16.

[41] See F Capra, U Matei, *The Ecology of Law: Toward a Legal System in Tune with Nature and Community* (Berrett-Koehler 2015)

[42] Non-fishing activities should also be factored in under an ecosystem approach more broadly, of course, but this is beyond the scope of this project.

[43] See section 2 infra.

[44] K McLeod, J Lubchenco, S Palumbi, A Rosenberg, "Scientific Consensus Statement on Marine Ecosystem-Based Management" (2005). Signed by 219 academic scientists and policy experts with relevant expertise and published by the Communication Partnership for Science and the Sea, at 1. See also S Murawski, "Ten Myths Concerning Ecosystem Approaches to Marine Resource Management" (2007) 31 Marine Policy 681-690.

mate change and ocean acidification. The Intergovernmental Panel on Climate Change (IPCC) has stated that:

> "[h]uman societies depend on marine ecosystem services, which are sensitive to climate change (*high confidence*) in particular the provisioning of food (fisheries and aquaculture) and other natural resources; nutrient recycling; regulation of global climate including production of oxygen (O2) and removal of atmospheric carbon dioxide (CO2); protection from extreme weather and climate events; and aesthetic, cultural, and supporting services"[45]

As observed in figure 1 below, catches projections for 2051-60 are considerably/negatively affected by warming ocean temperature alone - without considering the additive effects of fishing and ocean acidification.

In this connection, the IPCC has alerted about the effects and trends of ocean warming and acidification which have already been causing habitat and migratory pattern changes,[46] negatively affecting biodiversity and livelihoods. For example, studies have already noted that warming surface waters lead to fish migration pole-wards and into deeper waters.[47] As noted by Sumaila et al:

> "The magnitude of observed distribution shifts corroborate the model projections, and distribution shifts are expected to continue in the future under most emission scenarios. (…) A shift in species' geographic range will thus affect the distribution and composition of fisheries resources. This may affect fishing operations, the allocation of catch shares and the effectiveness of fisheries management measures, although it may also create new fishing opportunities."[48]

Based on literature review, the IPCC AR5 has concluded with high confidence that **marine ecosystems are being altered and will be further impacted by climate change in most of the developing world**.[49] In terms of exposure and vulnerability, it is not surprising that poor, marginalised communities and those most dependent on natural resources for their livelihoods are more susceptible to climate impacts. As noted by the IPCC:

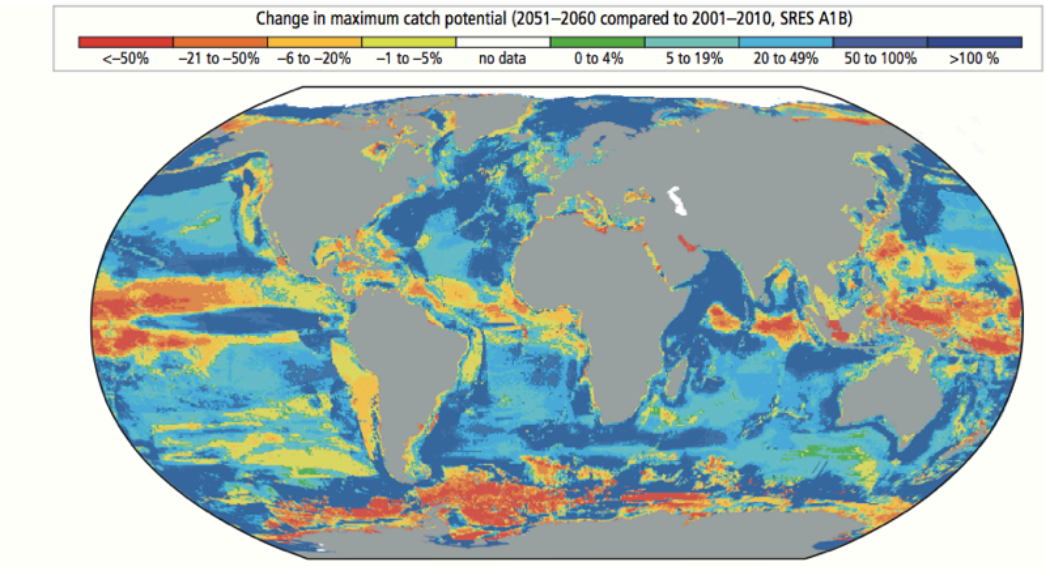

Figure 1: Climate change impacts projection (comparison between 2001-2010 and 2051-2060) on maximum fisheries catch (1,000 species) based on a single climate model under a moderate to high warming scenario, without analysis of potential impacts of overfishing or ocean acidification. (Figure from IPCC 2014)

[45] Pörtner et al, "Ocean Systems" in CB Field et al (eds), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press, 2014) 411-484, at 414.

[46] ibid.

[47] Sumaila et al (2011) supra note 12.

[48] Ibid, at 450.

[49] IPCC, *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)] (IPCC, 2014).

> "**Climate-related hazards exacerbate other stressors, often with negative outcomes for livelihoods, especially for people living in poverty (*high confidence*)**. Climate-related hazards affect poor people's lives directly through impacts on livelihoods, reductions in crop yields or the destruction of homes, and indirectly through, for example, increased food prices and food insecurity. Observed positive effects for poor and marginalized people, which are limited and often indirect, include examples such as diversification of social networks and of agricultural practices".[50]

In light of this, it is fair to conclude that the operationalisation of the ecosystem approach has been made more complex in the face of climate change. It is also concerning that the most vulnerable communities, including small-scale fishing communities in developing countries, are being affected more prominently. Therefore, **the need to integrate climate change effects into fisheries management has become even more pressing to ensure that adequate conservation and management measures (including adaptive measures) are put in place for ecological and social resilience building**.

B. The link between science, conservation approaches and international policy

This section focuses on the ecosystem approach to fisheries as a tool for conservation and sustainable use of marine living resources in a holistic manner. It is important to note that there is no single agreed definition of ecosystem approach,[51] despite the existence of a number of references and guidance for its implementation across different international fora, including under the Convention on Biological Diversity (CBD), the Food and Agriculture Organisation of the United Nations (FAO) and UN General Assembly (UNGA).

I. International policy on the 'Ecosystem Approach'

Even though the **1972 Stockholm Declaration on the Human Environment**,[52] which is classically seen as the birthmark of modern international environmental law, did not call for the implementation of an "ecosystem approach" and did not use terms such as ecosystem services per se, its Principles 2 and 6 expressly refer to ecosystems and the need to protect and carefully manage them for the benefit of present and future generations. Principle 3 calls for the need to restore and even improve Earth's ability to produce vital renewable resources. Forty years later, the 2002 World Summit on Sustainable Development (**WSSD) Plan of Implementation** called for the application of an ecosystem-based approach to the marine environment by 2010.[53]

The ecosystem approach was also recognised by parties to the **CBD** as early as in 1995 as the 'primary framework for action' in the elaboration and implementation of thematic and cross-cutting work programmes under the Convention,[54] and guidance on its meaning and implementation was enshrined in two decisions adopted respectively in 2000 and 2004.[55] CBD parties defined the ecosystem approach as: "… a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way"[56], and noted that

> "The ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organisation, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognizes that humans, with

[50] Ibid, at 54.
[51] UN, Report of the work of the UN Open-ended Informal Consultative Process on Oceans and the Law of the Sea at its Seventh Meeting (17 July 2006) UN Doc A/61/156, para 42.
[52] *Declaration of the UN Conference on the Human Environment,* 5 June 1972, UN Document A/Conf.48/14.
[53] *Plan of Implementation of the World Summit on Sustainable Development* (2002) Doc. A/CONF.199/20 [WSSD Plan of Implementation], Para. 30 (6).
[54] CBD Decision II/8 (1995) para 1.
[55] CBD Decisions V/6 (2000) and VII/11 (2004).
[56] CBD, Decision VII/11, Annex I, (A) (1).

their cultural diversity, are an integral component of many ecosystems."[57]

Importantly, 'ecosystem' is defined as "a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit."[58] CBD Decision V/6 further explains that the term 'unit' can refer to any functioning unit at any scale, which should be determined by the problem being assessed.[59]

On the basis of the CBD decisions the following inter-linked elements of the ecosystem approach can also be identified:[60]

a. integration of modern science and the traditional knowledge of indigenous peoples and local communities in adaptive management;[61]

b. a decentralised, social process to understand and factor in societal choices, rights and interests of indigenous peoples and local communities, and intrinsic as well as tangible and intangible values attached to biodiversity, and to balance local interests and the wider public interest;[62] and

c. fair and equitable benefit-sharing as a reward for traditional knowledge holders or more generally for ecosystem stewards.[63] This is an extensive notion of benefit-sharing (which goes beyond the narrower notion related to access to genetic resources and associated traditional knowledge[64] for research and development purposes), which has greatly influenced other areas of work of the Convention.[65] It implies that the State is expected to couple procedural guarantees for community participation in decision making and management planning with substantive measures for the legal recognition of communities' sustainable practices, the provision of guidance and support to improve the environmental sustainability of community practices, and the proactive identification of opportunities for better/alternative livelihoods in these endeavours, with a view to facilitating understanding of, and compliance with, the law.[66]

d. The application of ecosystem services valuation for calculating direct, indirect and intrinsic values, as well as for environmental impacts (effects or externalities).[67]

The last point shows that **valuation of ecosystem services (ES) can be seen as one of the elements of the ecosystem approach**. Interestingly, the recent UN First **World Ocean Assessment** (WOA) emphasised ecosystem services in a number of its chapters,[68] but did not contextualise ES in light of the ecosystem approach as the CBD and FAO have done previously. The 'ecosystem services' theme was selected as one of the 3 structural pillars of the WOA report,[69] accompanied by 'habitats', and 'pressures' on the marine environment. In that connection, the WOA concluded that "it is not yet possible to place a value on the non-marketed ecosystem services derived from the ocean",[70] including regulating and supporting services, as well as aesthetic, cultural and spiritual values. It also cautioned against over-emphasis on economically useful services in detriment of intrinsic values, which can exacerbate power asymmetries and enhance socio-ecological conflicts. [71] Against these cautionary findings, it is worth remarking that the WOA made use of the term **"ecosystem services *approach,*" which raises the question as to**

[57] CBD, Decision VII/11, Annex I, (A) (2).
[58] CBD, Art 2.
[59] CBD, Decision V/6, Para. 3.
[60] E Morgera, *The Ecosystem Approach under the Convention on Biological Diversity: A Legal Research Agenda* (SSRN, 2015), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2611918.
[61] CBD Decision V/6, Annex, Principle 11.
[62] CBD Decision V/6, Annex, Principle 1.
[63] CBD Decision V/6 para 9.
[64] CBD Decision VII/11, Annex I, annotations to rationale to Principle 10, where reference is made to 'the equitable sharing of benefits derived from the use of biodiversity'.
[65] For instance, the CBD work programme on protected areas (CBD Decision VII/27 (2004) Annex).
[66] This is a synthesis of a series of CBD Decisions analysed by E Morgera and E Tsioumani, "The Evolution of Benefit Sharing: Linking Biodiversity and Community Livelihoods" (2010), 19 (2) RECIEL 150-173, at 160–65.
[67] CBD, Decision VII/11, Annex I, Principle 4, Implementation Guidelines 4.2.
[68] E.g. Chapters 3, 8, 9, 10, 15, 16 of the UN First Global Integrated Marine Assessment: World Ocean Assessment I [WOA] (UN 2016).
[69] The purpose for using ES for structuring the report was to follow the same approach used in the MA. (see WOA (2016), Part I, Summary, at 3.
[70] WOA (2016), Part I, Summary, at 46.
[71] WOA (2016), Part III, Assessment of Major Ecosystem Services from the Marine Environment (Other than Provisioning Services), Ch 3, at 5.

whether this reflects a new trend towards the replacement of the broader notion of "ecosystem approach" with a narrower 'ecosystem services approach'.[72]

II. The Ecosystem Approach to Fisheries (EAF)

The terminology used in the WOA is particularly surprising as in the context of fisheries more specifically, **the ecosystem approach to fisheries** (EAF) has clearly emerged as a legal concept since the 1980s under the Convention on the Conservation of Antarctic Living Marine Resources (**CCAMLR**). Since then it has been incorporated into an array of policy instruments (e.g. UN General Assembly resolutions, FAO instruments), global treaties (UN Fish Stock Agreement) and more recently, a number of regional fisheries management organisations (RFMOs) convention texts.

While no single definition currently exists considering an array of different instruments, the FAO Technical Guidelines on Responsible Fisheries on EAF (**FAO EAF Guidelines**) define EAF by what it is intended to achieve, as follows:

> "An ecosystem approach to fisheries strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries." [73]

Different EAF-related instruments indicate that EAF aims to better address the practical needs of transboundary species and ecosystems, rebuild depleted stocks, and increase fishery productivity in a precautionary manner by considering the interaction between species and their habitats within natural boundaries (or biogeographic areas), and the carrying capacity of the ecosystem. The approach is also based on a better knowledge of ecosystem functions and structure, and the role of biodiversity in these processes.[74]

The FAO EAF Guidelines, which are aligned with the CBD guidance on ecosystem approach, also recommend that all pressures (i.e. from directed fisheries, bycatch, as well as other non-fishing pressures) to the marine ecosystem are taken into account when adopting fisheries management measures. To this end, the use of environmental impact assessments (**EIA**) to assess fisheries impacts on habitats, biodiversity, and non-directed species is required.[75] This requirement constitutes an obligation under the 1995 Fish Stocks Agreement.[76] To this end, the CBD process to describe areas that meet the ecologically or biologically significant marine areas (**EBSAs**)[77] as well as the identification of UNGA/FAO vulnerable marine ecosystems (**VMEs**) globally could contribute important biodiversity information to these impact assessments. A logical next step would be to assess the impacts (pressures, stressors, risks) of industrial fisheries and other potentially impactful activities to these areas to enable the development of appropriate conservation and management measures. In this light, the CBD has also developed Voluntary Guidelines for the consideration of biodiversity in environmental impact assessments and strategic environmental assessments in marine and coastal areas.[78] Furthermore, another very important instrument that provides clear criteria for the development of EIA is the FAO International Guidelines for the Management of Deep-Sea Fisheries in the High Seas.

The FAO EAF Guidelines also recommend the use of multi-species models, habitat identification and appropriate protection, through MPAs, fisheries closures, and other means. Another

[72] For this reason, this report refers instead to ecosystem services as a "concept" or "framework."

[73] FAO Fisheries Department. The ecosystem approach to fisheries. *FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 2.* (FAO, 2003) 112 p. [FAO EAF Technical Guidelines], at 6.

[74] CBD, Decision V/6.

[75] FAO (2003), supra note 73.

[76] UNFSA. Arts. 5 (d) and 10 (d).

[77] CBD, Decision IX/20 (2008), Annex I; Decision X/29 (2010). See also Decisions XI/17 (2012) and XII/22 (2014).

[78] CBD, Decision IX/17, B.

critical element of EAF is transparent and participatory decision-making.[79] Therefore, effective administrative institutions[80] are an essential requirement for the sound implementation and operationalization of a participatory and robust EAF. In fact, CBD Parties noted the need:

> *"…*for further improvement and implementation of the ecosystem approach in fisheries management by enhancing the capacity of [regional] fisheries management organizations, constructive inter-agency collaboration, and full and meaningful participation by a wide range of experts on biodiversity, indigenous and local communities, taking into consideration Article 8(j) and 10(c) of the Convention, and relevant stakeholders, as appropriate, in the fisheries management process"[81]

Even though the implementation of EAF has been slim to date, an often forgotten or one of the least implemented elements of EAF is the incorporation of a social dimension. The FAO EAF Guidelines recognise that the **improvement of human wellbeing and equity** is one of the principles of EAF,[82] and provide recommendations on the development of "appropriate multispecies bio-economic models, as well as extended ecological models that include the economic and social dimensions (private and societal returns, income distribution, employment, incidence of poverty and impact on food security)."[83] In considering bio-economic models, the EAF Guidelines introduce the notion of economic valuation[84] to internalize the environmental costs or externalities and better inform fisheries management decisions in connection with ecosystem goods and services. However, it recognizes the limitations of valuation in light of insufficient information regarding complex environmental systems and "about important ecological processes underpinning the various values generated by the system."[85]

Further, in 2010, the CBD **Aichi Target 6** called for the sustainable management of fisheries and the application of ecosystem-based approaches, with no significant adverse impact on vulnerable ecosystems (e.g. coral reefs, seagrasses, cold water corals and sponges) and threatened species, and impacts on ecosystems and species being within at a safe ecological level.[86] The fourth edition of the Global Biodiversity Outlook (GBO4) concluded that at the current pace of implementation, the target will not be achieved by 2020.[87] The **linkages between this target and other Aichi targets** (e.g. targets 10 and 11 on protection of ecosystems vulnerable to climate change, and MPAs, respectively; targets 5 and 12 on habitat and species protection; and target 18 on traditional knowledge) were highlighted as an important means for enhancing implementation. GBO4 also underscored the important role of **co-management** arrangements for enhancing fisheries management outcomes. The South Pacific network of hundreds of Locally Managed Marine Areas (LMMAs), as well as LMMAs in Madagascar, Kenya, Spain and Japan were perceived as a successful experience in this regard.[88] Some of these experiences will be analysed in the case studies phase of this project.

III. The Precautionary Approach

The precautionary approach, described in Principle 15 of the Rio Declaration, is an **intrinsic component of the ecosystem approach** including through environmental assessments and monitoring.[89] As current knowledge of ecosystem functioning is incomplete, the ecosystem approach is tightly linked to precaution:

[79] FAO EAF Guidelines (2003), supra note 73.
[80] See F Fukuyama, *Political Order and Political Decay: From the Industrial Revolution to the Globalization of Democracy* (FSG, 2014).
[81] CBD Decision XI/18, A (2).
[82] FAO EAF Guidelines (2003), supra note 73 , at 85.
[83] Ibid, at 65.
[84] See CBD Decision III/18 (1996) on economic valuation of biodiversity; and CBD Decision VIII/25 (2006), which includes a series of options for the application of tools for valuation of biodiversity and biodiversity resources and functions. See section 3 infra.
[85] FAO EAF Guidelines (2003), supra note 73, at 93.
[86] CBD, Decision X/2.
[87] CBD Secretariat, *Global Biodiversity Outlook 4* [GBO4] (CBD, 2014).
[88] Ibid.
[89] CBD Decision VII/11, Annex I, Principle 6, Implementation Guideline 6.2; FAO, The ecosystem approach to fisheries management. Topics Fact Sheets. Text by S.M. Garcia and K.L. Cochrane. In: *FAO Fisheries and Aquaculture Department* (2005), online at: http://www.fao.org/fishery/topic/13261/en.

it is predicated on the application of appropriate scientific methodologies and on the adoption of adaptive management to deal with the complex and dynamic nature of ecosystems.[90] It also calls for a cautious approach in respecting the limits of ecosystem functioning.[91] In addition, through adaptive management, it calls for an ongoing learning process: responding to changing circumstances and new knowledge, as well as generating new knowledge and reducing uncertainties, thereby allowing management to anticipate and cater for change.[92]

While there is a clear link between the ecosystem approach and the precautionary approach in international environmental and fisheries law, tensions between these concepts have also been identified. Tarlock, for instance, argued that adaptive management 'corrects the bias [of the precautionary principle] towards no action in the face of uncertainty and the opposite bias for immediate fixes unconnected to long-term monitoring, assessment and adjustment to changes conditions and information'.[93] Brunnée and Toope, in turn, cautioned against injecting cost-effectiveness, as part of the precautionary principle, into the ecosystem approach, arguing that cost-effectiveness could serve as a 'normative backdoor for business as usual'.[94]

The precautionary approach has reached a significant level of specification for fisheries in the UN Fish Stocks Agreement (UNFSA).[95] In particular, the UNFSA sets the obligation of rebuilding depleted stocks and ecosystems by setting guidance for the development of precautionary reference points for fisheries management, and improves on the older target of achieving maximum sustainable yield (MSY) when setting total allowable catch as previously established by UNCLOS.[96] A number of authors concur that MSY as a target is not sustainable.[97]

Therefore, UNFSA improved the MSY requirements by setting MSY as a limit to be avoided rather than a target[98] - a notion that was followed by the Future We Want and the Sustainable Development Goal (SDG) 14.4. Other policy instruments, including the FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries (SSF Guidelines), the FAO Deep Sea Fisheries Guidelines, the Future We Want (reaffirmed by SDG target 14.c) expressly call for the implementation of the precautionary approach in the context of fisheries.

However, 30 years after the adoption of UNFSA, **implementation of precautionary reference points remains far from being widely applied. Accurate catch data (through reporting), scientific surveys and stock assessments (scientific capacity) are a pre-condition** for the establishment of these reference points. Catch misreporting (or unreported fishing catch data) remains a common practice, and enforcement is costly, especially for developing countries. Another major challenge is that small-scale fisheries are commonly under-reported in developing countries,[99] making accurate catch estimations a much more difficult undertaking. This has also implications for the way that fishery surplus is calculated for the negotiation of bilateral fisheries access agreements. **If based on MSY as a target, the "surplus" available to foreign fleets will be larger than if based on precautionary reference points. This may hinder recovery of declining stocks and thus affect small-scale fishing communities that are**

[90] CBD Decision V/6, Annex, paras 2 and 4.
[91] CBD Decision V/6, Annex, Principle 6.
[92] CBD Decision VII/11, Annex I, Annotations to the Rationale of Principle 9.
[93] D Tarlock, "Ecosystems" in D Bodansky, J Brunée & E Hey (eds), *The Oxford Handbook of International Environmental Law* (OUP, 2014),581–582.
[94] J Brunnée, S Toope, "Environmental Security and Freshwater Resources: A Case for International Ecosystem Law", (1994) 5 YbIEL 41-76,at 69.
[95] UNFSA, Art. 5 (c) and (ed); Art. 6 and Annex II
[96] D Diz, *Fisheries Management in Areas beyond National Jurisdiction: The Impact of Ecosystem Based Law-Making,* (Brill, 2013).
[97] See PA Larkin, "An epitaph for the Concept of Maximum Sustained Yield." (1977) 106 (1) *Transactions of the American fisheries society* 1-11; Pauly (2010), supra note 38. See also Longhurst (2010), supra note 16, where he notes the following: ""In writing its epitaph, Larkin evoked the level of enthusiasm and certainty in American fisheries science during what he calls that golden age for the model of maximum sustainable yields, when it was the duty of fisheries science to ensure that the seas everywhere were harvested to this maximum." (at 3)
[98] UNFSA, Annex II.
[99] F Le Manach, et al, "Unreported Fishing, Hungry People and Political Turmoil: The Recipe for a Food Security Crisis in Madagascar?" (2012) 36 (1) Marine Policy 218-225.

dependent on the same overfished fishing resources or associated species and ecosystems that may also be affected. These observations about the challenges in implementing the precautionary approach serve to confirm the need to consider decision-making on fisheries management **at different scales** to understand how the ecosystem approach can be implemented in its environmental, social and economic components at local level. The legal analysis that will be carried out in the second phase of this project will be particularly focused on exploring these connections.

In addition, as the implementation of the ecosystem and precautionary approach to fisheries requires a certain level of knowledge of the marine ecosystems and scientific capacity and technology (see Section 4 infra) to conduct scientific surveys and run computer models, international obligations and **commitments on capacity building, technology transfer and scientific cooperation[100] are of relevance for present purposes,** especially in the context of SDG 17 (on means of implementation). The legal analysis that will be carried out in the second phase of this project will thus also focus on the implications of international cooperation on the marine environment and sustainable fisheries for local efforts to support small-scale fishing communities.

IV. Marine Bioregions

Bioregionalisation of the oceans is a necessary first step for defining ecosystem units for ecosystem-based management, including EAF, as well as for habitat protection such as ecologically representative networks of marine protected areas (MPAs)[101] which can also be a tool for fisheries management.[102] Safeguarding ecological processes that underpin provisioning services often require conservation measures that reduce multiple anthropogenic impacts (not only fishing impacts), such as MPA networks as part of an integrated coastal and oceans management for the achievement of an ecosystem approach.[103] Ecologically representative networks of MPAs offer protection from eventual marine and coastal management failures outside the MPAs,[104] while increasing resilience against existing and future threats. According to Johnson et al, "[i]ncreasingly, recognizing the critical role of oceans and marine ecosystems in global cycles and the control of climate, developing suites of MPAs at the regional scale can also contribute to climate change adaptation strategies."[105] In accordance with scientific studies, habitat representativity is also considered to be necessary for meeting conservation and fisheries goals, as "marine species tend to segregate by habitat (e.g., depth, substrate, salinity and other factors) and often use different habitats during different life stages".[106]

On the other hand, while longer-term benefits (e.g. spill-over effects, increased resilience, etc) may be accrued, some types or MPAs or MPA zones can restrict access of small-scale fisheries, or local communities to immediate benefits, creating possible social injustices[107] if not adequately planned and implemented. Nevertheless, there are a number of different categories of MPAs globally, ranging from

[100] M Ntona, "The transfer of marine technology as benefit-sharing" at http://www.benelexblog.law.ed.ac.uk/2015/11/04/the-transfer-of-marine-technology-as-benefit-sharing/; Mara Ntona, http://www.benelexblog.law.ed.ac.uk/2015/11/01/benefit-sharing-and-marine-scientific-research/; and E Morgera, "Fair and Equitable Benefit-sharing at the Cross-roads of the Human Right to Science and International Biodiversity Law" (2015) 4 Laws 803-831, at http://www.mdpi.com/2075-471X/4/4/803); see also SDG target 17.6.

[101] D Johnson et al, "When is a marine protected area network ecologically coherent? A Case Study from the North-east Atlantic" (2014) 24 (2) Aquatic Conservation: Marine and Freshwater Ecosystems 44-58; CCAMLR EMM 10/30; Diz (2013).

[102] FAO, EAF Guidelines (2003), supra note 73; see also Diz (2013), supra note 96.

[103] See FAO SSF Guidelines, Para.10.2; Diz (2013), supra note 96; See also KL Cochrane, SM Garcia (eds.), *A Fishery Manager's Guidebook,* 2nd edition, (Wiley-Blackwell & FAO, 2009).

[104] J Rice, K Houston, "Representativity and Networks of Marine Protected Areas" (2011), 21 (7) Aquatic Conservation: Marine and Freshwater Ecosystems 649-657.

[105] Johnson et al (2014), supra note 101.

[106] SD Gaines, C White, MH Carr, SR Palumbi, "Designing Marine Reserve Networks for Both Conservation and Fisheries Management (2010) 107 (43) PNAS 18286-18293, at 18288.

[107] A Martin, A Akol, J Phillips, "Just Conservation? On the Fairness of Sharing Benefits" in T Sikor (ed.), *The Justices and Injustices of Ecosystem Services* (Earthscan/Routledge, 2013), ch 4.

complete no-take areas in terms of extractive activities to a merely sustainably managed area where all activities are allowed as long as in accordance with minimum standards.[108] Artisanal fisheries can be perfectly incorporated within this range of possibilities. **A closer look at whether and how MPAs and other area-based management tools such as Locally Managed Marine Areas (LMMAs)[109] could be designed to reduce social injustices while protecting the intrinsic values of marine biodiversity would be an appropriate next step in the context of the Marine Benefit project's case studies**.

In addition to contributing to MPA designs (and ecologically representative MPA networks), bioregionalisation is a necessary tool (and element) for EAF in the determination of **production potential and sustainable limits** of a particular ecosystem unit. In a recent technical study,[110] the FAO has used the large marine ecosystems (LMEs) as units to estimate production levels (see fig 2 below). The authors suggest that **exploitation rates should not exceed 20%-25% of the available production per unit to ensure the sustainability of the system as a whole including top predators such as seabirds[111] and marine mammals.**[112]

The Northwest Atlantic Fisheries Organization (NAFO) has adopted a similar approach in the context of their Ecosystem Approach to Fisheries Management Roadmap. NAFO scientists have subdivided the bioregion (LME) even further using oceanographic and geographical characteristics (with distinct productivity and well-defined community/food web system) for the identification of fishery production units.[113] Guidance for the development of ecosystem-level total allowable catch ceilings for each unit

Estimated production levels in the absence of exploitation by functional group for LMEs represented in this study

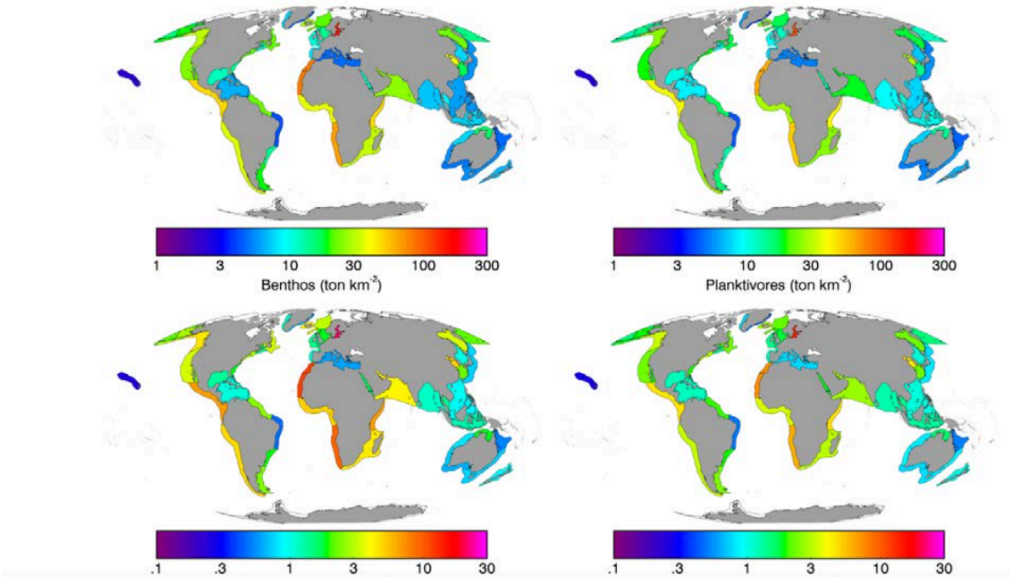

Figure 2: LME Estimated production by functional group (from FAO, 2014)

[108] IUCN, *Guidelines for Applying the IUCN Protected Area Management Categories to Marine Protected Areas* (IUCN, 2012).

[109] Concerns about the enforceability of LMMAs have been raised (See: S Rocliffe, S Peabody, M Samoilys, JP Hawkins, "Towards a Network of Locally Managed Marine Areas (LMMAs) in the Western Indian Ocean." (2014) 9 (7) PLoS ONE e103000). The legal analysis and the case studies will also consider this important issue along with equitable management.

[110] AA Rosenberg et al, *Developing New Approaches to Global Stock Status Assessment and Fishery Production Potential of the Seas* (FAO, Fisheries and Aquaculture Circular No. 1086, 2014).

[111] See PM Cury, et al. "Global Seabird Response to Forage Fish Depletion—One-Third for the Birds" (2011) 334 (6063) Science 1703-1706.

[112] AA Rosenberg et al (2014), supra note 110.

[113] NAFO, *Report of the Scientific Council Meeting*, 29 May-11 June 2015 (NAFO SCS Doc 15-12 (Revised)).

is being developed based on the same methodology used by FAO LME study referred to above.[114]

By accepting and defining the limits of ecosystems' production in terms of goods and services, the ecosystem approach has the potential to restore ecosystem functions and processes that in turn support the provisioning of these services. It can also be argued that the concept of "planetary boundaries" can be applied to marine ecosystems, through the ecosystem approach and integrated oceans management.[115] The notion of planetary boundaries or limits has been explored in the context of systems integration and systems thinking theories. As highlighted by Liu et al: "Planetary boundaries are threshold levels for key Earth system components and processes (such as stratospheric ozone, global freshwater, and nitrogen cycling) beyond which humanity cannot safely be sustained […]. Quantifying the above frameworks relies on systems integration".[116] Thus, **defining precautionary ecosystem-level thresholds for fisheries catch combined with appropriate bycatch minimisation measures and habitat protection could contribute to the maintenance and to a certain degree of rebuilding of ecosystem structure and function.**

V. Key challenges in implementing the ecosystem approach

The preceding sections have illustrated that while EAF seems to be a promising, holistic approach for sustainable fisheries, its full implementation is a challenge, as it requires ecosystem knowledge that depends on accurate information including catch data. Increasingly, it also requires managers to incorporate the effects of climate change, given the rapid rate of associated changes in marine and coastal ecosystems, including habitat loss and changes in migration patterns of species.

EAF incorporates a number of principles (such as the precautionary approach, as per above, and equity, participation and inclusiveness) and tools (e.g. impact assessments, habitat protection, selective methods to avoid bycatch, multi-species modelling, MPA networks) in the context of biogeographic units and subunits. It also aims to respect the production limit of the ecosystem in question to avoid its depletion. **While each of these principles and tools remain work in progress, there is another relevant question that has been studied the least: How are the benefits derived from sustainable fisheries supposed to be shared within States? This question is particularly relevant as international policy increasingly links marine ecosystems and poverty alleviation.**

VI. International policy on marine ecosystems and poverty

At the 2012 UN Conference on Sustainable Development (UNCSD or **Rio+20**), States recognised the links between poverty eradication and ecosystem conservation, regeneration, restoration and resilience in the context of sustainable development.[117] In this connection, States also recognised that "many people, especially the poor, depend directly on ecosystems for their livelihoods, their economic, social and physical wellbeing, and their cultural heritage."[118] States also stressed the essential role of healthy marine ecosystems and sustainable fisheries in ensuring food security and nutrition, and in providing for the livelihoods of millions of people worldwide.[119] States thus committed to

> "… protect, and restore, the health, productivity and resilience of oceans and marine ecosystems, and to maintain their biodiversity, enabling their conservation and sustainable use for present and future generations, and to effectively apply an ecosystem approach and the precautionary approach in the management, in accordance with international law, of activities impacting on the marine environment, to deliver

[114] Ibid.
[115] J Liu, et al, "Systems Integration for Global Sustainability" (2015), 347 (6225) Science 1258832-1-9.
[116] Ibid, at 1258832-1.
[117] UNCSD, The Future We Want, Para. 4.
[118] Ibid, para. 30.
[119] Ibid, para. 113.

on all three dimensions of sustainable development."[120] (emphasis added)

Importantly, this paragraph is reaffirmed under **Target 14.c of the Sustainable Development Goals** (SDGs). What remains to be studied, however, is the relationship between SDG 14 and other SDGs, including goals 2 (on food security and nutrition), 10 (on inter-state inequality), 16 (on peace, access to justice for all, inclusive decision-making, and strong institutions), 17 (on the means of implementation, including through technology transfer and access to science), as the 2030 Agenda for Sustainable Development emphasise the role of oceans and coasts for sustainable development, including with respect to poverty reduction, food security, nutrition, wellbeing and traditional livelihoods. **The relevance of the SDGs targets (and mechanisms for their implementation), as well as their interface with other existing targets, such as the CBD Aichi Biodiversity targets, will be further explored throughout this project, including through a special journal issue involving external experts (a concept note for the special issue will be shared with our Advisors in early March 2016).**

In effect, a growing body of international policy instruments has been calling for the **application of the ecosystem approach, including EAF, in the context of poverty reduction**. It is expected that the implementation of the EAF may contribute to the equitable and long-term conservation and sustainable use of marine resources, which in turn will generate ecosystem services that human societies depend upon, including the most vulnerable communities. One of these references can be found in the **FAO SSF Guidelines** which also make several references to the ecosystem approach to fisheries, as well as to the precautionary approach,[121] and to the **equitable sharing of the benefits** yielded from the responsible management of fisheries and ecosystems, with a particular view to rewarding small-scale fishers and fish workers, in connection with their social and cultural wellbeing, their livelihoods and sustainable development.[122]

While international policy-making has underscored the link between EAF and poverty, however, as it will be further discussed in the next section, **fewer policy instruments and insufficient research have addressed the connection between poverty alleviation and marine ecosystem services per se.**

3. The Policy and Scholarship of Ecosystem Services

This section aims at exploring the development of the "ecosystem services" (ES) concept and approaches in relevant policy instruments and scholarship with a view to assessing the opportunities and limitations of the ES concept to contribute to implement the ecosystem approach, including benefit-sharing. In order to do this, following a brief section on the definition of concepts (different forms of ES and the notion of 'value') and tools (e.g. payment for ecosystem services; management trade-offs) related to ecosystem services and their links with human wellbeing. We will then explore the evolution of the concepts and their incorporation in relevant international policy instruments. Conclusions from these sections will help inform the subsequent discussion on the scholarship of ES in relation to marine ecosystems across biogeographical and governance scales.

A. Defining the concept(s) of Ecosystem Services

In 2005 the UN-level Millennium Ecosystem Assessment (MA) adopted a widely accepted definition of ecosystem services, namely, "the

[120] Ibid, para. 158.

[121] FAO SSF Guidelines, Para. 5.1 makes express reference to benefit sharing; See also Diz, "Introducing the Marine Benefits Project" (2015) online: <http://www.benelexblog.law.ed.ac.uk/2015/10/19/introducing-the-marine-benefits-project-benefit-sharing-and-small-scale-fisheries/>

[122] Ibid, para 5.1.; D Diz, ibid.

benefits people obtain from ecosystems".[123] As highlighted by Mace et al, "[e]cosystems therefore represent a branching network that starts with fundamental ecological and evolutionary processes and leads through final ecosystem services to the ecosystem components and outputs from which humans directly derive goods and benefits".[124]

The MA classified the different types of ecosystem services into four main categories:[125]

a. **Provisioning services**, such as food, water, timber, and fiber;

b. **Regulating services**, such as those that affect climate, floods, disease, water quality and wastes;

c. **Cultural services**, as "the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience, including, e.g., knowledge systems, social relations, and aesthetic values"[126]; and

d. **Supporting services**, such as soil formation, photosynthesis and nutrient cycling.

It is well established that marine and coastal ecosystems provide **provisioning services** in the form of food (e.g. fishing resources), biotic materials (e.g. medicinal and nutraceutical products), biofuels.[127] Marine and coastal ecosystems also provide **regulating services** such as coastal protection from storms, flooding and erosion (e.g. provided by mangroves, coral reefs, dune systems, barrier islands, oyster reefs, etc), climate regulation (e.g. carbon sinks provided by phytoplankton, mangroves, saltmarshes, seagrasses, krill), and water purification (e.g. by mangroves, saltmarshes, sponges). The UN World Ocean Assessment (WOA) has a dedicated chapter on **cultural ecosystem services** (tourism, religion, aesthetics, traditional knowledge), however, the WOA recognised significant knowledge gap in this field, and noted that "the understanding and visibility of socio-cultural-health-economic benefits from ecosystems (i.e., the understanding of the *demand for ecosystem benefits*) remain fragmented and are lagging behind, especially for oceans."[128] Finally, the WOA has highlighted the essential role played by **supporting services** of marine ecosystems, such as primary production and nutrient cycling, as an underlying condition for all services, including regulating and cultural. [129]

It is important to note that the same ecosystem or species often provides a range of services simultaneously (e.g. fish contribute to nutrient cycling, biological regulation, food, etc). Therefore, **a single human activity can affect multiple ecosystem services**. For example, overfishing of herbivore species can lead to coral reef loss due to algae increase. In turn, coral loss can reduce not only biodiversity and fishery production, but also reduce coastal protection from storms. Furthermore, coral bleaching caused by warming ocean temperatures and climate change can also impact fisheries, the ability of the reef to protect coastal areas, among others. **These dynamics are important to understand when considering trade-offs in decision-making, including trade-offs among different ecosystem services**.

I. The link between ecosystems services and human wellbeing

The link between ecosystem services (and associated biodiversity) and human wellbeing is recognised by the MA thorough the following rationale: Humans depend on the **flow of ecosystem services** that rely on **natural capital (or stock),**[130] which, in turn, depends on a

[123] Millennium Ecosystem Assessment [MA], *Ecosystems and Human Wellbeing: Synthesis* (2005), at v.

[124] GM Mace, K Norris, AH Fitter, "Biodiversity and Ecosystem Services: A Multilayered Relationship" (2012) 27 (1) Trends in Ecology and Evolution 19 – 26, at 20.

[125] MA, *Ecosystems and Human Wellbeing: Synthesis* (2005), at v.

[126] Ibid, at 40.

[127] C Liquete et al, "Current Status and Future Prospects for the Assessment of Marine and Coastal Ecosystem Services: A Systematic Review" (2013) 8(7) PLoS ONE e67737.

[128] WOA (2016), Part III, Ch 3, at 16.

[129] WOA (2016), Part III, Ch 3, at 7.

[130] Natural capital is understood as "… the world's stocks of natural assets which include geology, soil, air, water and all living things" (Natural Capital Forum, http://naturalcapitalforum.com/about/), or "…the living

healthy **biodiversity** status.[131] Conversely, the MA directly links **changes to ecosystem services to impacts on human health and welfare**.

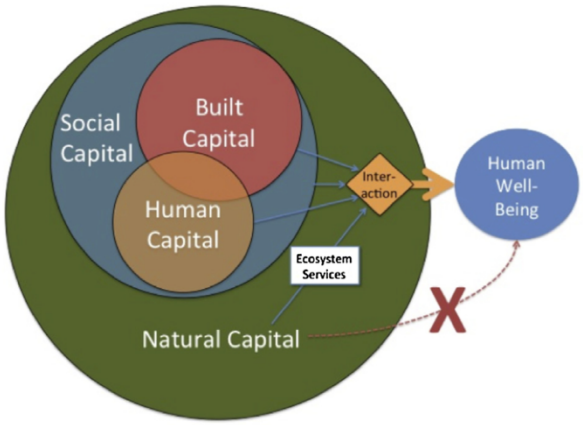

Figure 3: Relationship between natural capital with social capital (including economic capital in the form of built and human capital) towards human wellbeing, indicating that natural capital does not contribute directly to human wellbeing, but through the flows of ecosystem services (from Costanza et al (2014)).

Wellbeing is difficult to measure and has been the subject of different definitions.[132] In general, the notion of wellbeing includes elements such as material needs, freedom of choice and action, health, security, social relations, and healthy environment.[133] Thus, **the MA has acknowledged that wellbeing is at the opposite spectrum from poverty.**[134] Nevertheless, the conceptualisation of ecosystem services by the MA has also attracted criticisms for not truly incorporating **equity and fairness**,[135] which in certain cases might aggravate conflicts between environmental conservation and resource use in an intra-generational perspective. Along similar lines, a study by UNEP-WCMC on marine and coastal ecosystem services valuation has also suggested that "[o]ften, equity objectives are considered separately, with groups of "winners" and "losers" from specific projects or policies being identified, and this information is considered alongside valuation and other information in decision-making processes."[136] Given the highly dynamic and transboundary nature of marine ecosystems, tracing the winners and losers across space and time is often a more difficult task than terrestrial ecosystems. In addition, questions have also been raised on whether in practice the ecosystem services literature sufficiently takes into account the future flows of ecosystem services, which is an essential component of inter-generational equity and sustainability.[137]

It thus appears important to contrast the **lack of clarity with regard to the link between equity and ecosystem services** with (intra- and inter-generational) equity and fairness components of the CBD ecosystem approach.[138] The ecosystem approach may provide a broader (and complementary) framework for the investigation and analysis of equity and justice than the ecosystem service framework alone (especially when considering wellbeing in all its forms). **Consideration of the international obligations underpinning the ecosystem**

and nonliving components of ecosystems […] that contribute to the generation of goods and services of value for people". See AD Guerry et al, "Natural Capital and Ecosystem Services Informing Decisions: From Promise to Practice" (2015) 112 (24) PNAS 7348-7355, at 7349. While 'natural capital accounting' has been defined as "[t]he systematic measurement, valuation, recording and analysis of information relating to impacts and dependencies on natural capital" (Natural Capital Forum, Guide to Terminology, http://naturalcapitalforum.com/news/article/your-guide-to-world-forum-on-natural-capital-terminology/)

[131] MA (2005); but see S Lele "Environmentalisms, Justices and the Limits of Ecosystem Services Frameworks" in T Sikor (ed), *The Justices and Injustices of Ecosystem Services* (Earthscan/Routledge 2011), ch 6.

[132] KK Sangha et al, "Ecosystems and Indigenous Wellbeing: An Integrated Framework", (2015) 4 Global Ecology and Conservation 197-206; See also OECD, *How's Life?: Measuring Wellbeing* (OECD, 2011).

[133] Sangha et al (2011), ibid, at 198.

[134] Millennium Ecosystem Assessment, *Ecosystems and Human Wellbeing: Synthesis*, (Island Press, 2005), at 50.

[135] Lele (2011), supra note 131, at 126. Lele argues that the terms "fairness, justice or equity" are not incorporated in the outcome variables of the ES as presented in the MA, apart from the one on freedom of choice and action. It would be useful, however, to contrast the MA conceptualization with the emerging assessments of the IPBES, particularly the marine IPBES assessment which is due in 2017-18, and investigate if/how the concept has evolved since 2005 in this respect.

[136] UNEP-WCMC, *Marine and Coastal Ecosystem Services: Valuation Methods and their Application*, (UNEP-WCMC Biodiversity Series No. 33, 2011), at 33.

[137] Lele (2011), supra note 131.

[138] CBD, Decision VII/11, paras. 1, 3; and table 1, principles 1, 4, 10, 12.

approach (including the reference to "equitable" in relation to benefit-sharing), therefore, adds value to the ecosystem services discourse by bringing about a broader approach that systematically included equity issues.

II. Valuation vs Values: the role of procedural fairness

Research on valuation of ecosystem services has been a growing field over recent decades. The valuation of environmental externalities has been the object of study by economists for considerably longer, and used by managers in different contexts, such as in watershed management to calculate user/polluter fees.[139]

Valuation of ecosystem services comprises both monetary and non-monetary values.[140] **Total economic value** (TEV) is the terminology used to describe different types of economic value (i.e. utilitarian, and non-utilitarian values).[141] For instance, coral reefs have been the object of valuation exercises, which have estimated that they contribute to livelihoods by a figure surpassing US$ 30 billion.[142] Benefits from reef systems directly contribute to the livelihoods and subsistence of at least 275 million people.[143] More broadly, coral reefs generates benefits to roughly 850 million people globally who live within 100km distance from these reefs.[144]

Economic valuation of ecosystem services can be used in several contexts. For instance, it can assess the monetary cost of environmental damage for compensation purposes, biodiversity offsets, calculation of environmental fines, and to inform trade-offs in decision-making processes.[145] Valuation has thus been perceived by many as the only way to **give nature a "voice**". Arguably, valuation could help decision-makers to be better prepared to identify short and long-term trade-offs between conservation and development measures and portfolios of activities.[146] Valuation is often followed by decision-making supporting tools, such as: cost-benefit analysis and cost-effectiveness analysis (based on monetary valuation); multi-criteria analysis, and deliberative and participatory processes (often based on non-monetary valuation), liability and redress,[147] among others.[148] Among these tools, deliberative and participatory processes have been acknowledged for promoting the recognition of traditional knowledge of ecosystem services including the traditional values of traditional knowledge holders,[149] which is an important consideration for achieving equity and fairness in the context of an ecosystem approach, as briefly discussed above.

However, the science and practice of valuation has still important shortcomings. The value of intermediate services such as regulating and supporting services are normally not accounted for in valuation exercises as often these values are reflected in the final services or benefits that they support.[150] Similarly, cultural services, including spiritual values, cultural identity and traditional knowledge, tend to be difficult to quantify in monetary terms,[151] and can be subjective to individuals or groups within society. Hence some authors have concerns that due to such incommensurability, cultural services can be easily sidelined in ecosystem services exercises, which tend to focus on

[139] D Diz, LT Soeftestad, "Water Resources as a Common Good in Brazil: Legal Reform between Theory and Practice (2004), in *Anais da IX Conferência Bianual, International Association for the Study of in Common Property (IASCP). Oaxaca, México*.

[140] CBD Secretariat, *An Exploration of Tools and Methodologies for Valuation of Biodiversity and Biodiversity Resources and Functions*, (CBD Technical Series no. 28, 2007).

[141] CBD, Technical Series no. 28 (2007) ibid.

[142] JN Kittinger, EM Finkbeiner, EW Glazier, LB Crowder, "Human Dimensions of Coral Reef Social-Ecological Systems" (2012) 17(4) Ecology and Society 17.

[143] UNEP, Coral Reef Unit, online: <http://coral.unep.ch/Coral_Reefs.html>

[144] WWF/ZSL (2015), supra note 27

[145] TEEB, *Why Value the Oceans - A discussion paper* (February 2012).

[146] See section C infra on the scholarship of ecosystem services.

[147] See EC Directive 2004/35/EC on environmental liability, para. 1.2.3. The Directive recognizes the role of monetary valuation when resource-to-resource or service-to-service equivalence approaches is not possible in the identification of compensatory remedial measures.

[148] CBD, Technical Series no. 28 (2007), supra note 140.

[149] Ibid.

[150] UNEP-WCMC (2011), supra note 136.

[151] KM Chan et al, "Where are Cultural and Social in Ecosystem Services? A Framework for Constructive Engagement" (2012) 62 (8) BioScience 744-756.

provisioning services, with the result that valuations risk weakening respective outcomes in decision-making process.[152] **Consideration of the international obligations related to procedural fairness (including the reference to "fair" in relation to benefit-sharing), therefore, could add value to the ecosystem services discourse by shedding light on the role of deliberative and participatory decision-making processes in relation to valuation.**

III. Payments for ES

While the valuation of ecosystem services is expected to comprises both monetary and non-monetary values, a lot of attention has been paid in particular to payment for ecosystem services (PES) as one of the mechanisms for translating the ES values into investments or financing tools for conservation.[153] PES has been increasingly utilised globally but mostly in terrestrial ecosystems (e.g carbon sinks, easements, agri-environmental schemes, watersheds).[154] Given the legal nature of the marine environment as a global and national commons (not subject to appropriation), the adoption of PES schemes can be challenging. On the other hand, PES schemes may help tackle over-exploitation of living resources through compensation for the establishment of MPAs, for example.[155] While remaining a controversial approach, a number of studies have concluded that PES schemes may also contribute to poverty reduction.[156] **Under the CBD, PES are one option for fair and equitable benefit-sharing,[157] but insufficient attention has been paid to this aspect in the legal literature on the ecosystem approach to fisheries.**

B. History of Ecosystem Services in the international policy agenda

This section aims to assess the impact of the ecosystem services concept in global policy-making since the MA publication. Despite the fact that ecosystem services were not mentioned in the 2005 UN World Summit outcome document,[158] the MA was successful in initiating the ecosystem service debate under a number of multilateral environmental agreement such as at the CBD and the Ramsar Convention.[159]

In effect, the need for ecosystem services valuation was incorporated in the form of principle 4 (economic context) of the CBD ecosystem approach implementation guidelines since 2004.[160] These guidelines recommend the application of valuation methodologies for ecosystem goods and services (direct, indirect and intrinsic values) including in regard to environmental impacts (effects or externalities) as part of the ecosystem approach. Principle 4 also calls for the reduction of market distortions (e.g. due to subsidies[161] and taxes) that adversely affect biodiversity.[162] Harmful fisheries subsidies, for instance, have been the object of increased attention by the international community,[163] but stalled discussions at the World Trade Organisation (WTO) have been hindering progress on the issue. This suggests that the ecosystem services discourse does not seem to have influenced WTO on this issue to date.

Nevertheless, other international initiatives have been more successful, such as The Economics of Ecosystems and Biodiversity

[152] Ibid.
[153] TEEB (2012) supra note 145.
[154] S Engel, S Pagiola, S Wunder, "Designing Payments for Environmental Services in Theory and Practice: An Overview of the Issues" (2008) 65 Ecological Economics 663-674.
[155] EY Mohammed, *Payments for Coastal and Marine Ecosystem Services: Prospects and Principles* (IIED Briefing, May 2012).
[156] Engel et al (2008), supra note 154; but see Lele (2011), supra note 131.
[157] CBD, *Akwé: Kon Voluntary Guidelines* (2004), para 46.
[158] UNGA Resolution A/RES/60/1, (2005), World Summit Outcome.
[159] See E Morgera, "The 2005 UN World Summit and the Environment: The Proverbial Half-Full Glass" (2006) 15 *Italian Yearbook of International Law* 53-80.
[160] CBD, Decision VII/11, table 1, Principle 4.
[161] Ibid.
[162] Ibid.
[163] WSSD JPOI; The Future We Want; SDG 14, CBD Aichi Target 6, etc.

(**TEEB**) as a global initiative focused on "making nature's values visible".[164] TEEB emerged out of a commitment made by environmental ministers of the G8+5 during a meeting in Germany in 2007 to initiate a process to analyse the "global economic benefit of biological diversity, the costs of the loss of biodiversity and the failure to take protective measures versus the costs of effective conservation."[165]

In 2008, the CBD Conference of the Parties (COP) encouraged parties and relevant organisations to assess the economic costs of biodiversity loss and related ecosystem services, including by contributing to such a global study,[166] emphasising the importance of valuation[167] for biodiversity conservation and sustainability. The TEEB reports have then been welcomed by the CBD COP in 2010 and have influenced the adoption of **Aichi target 2**, which commits States parties to the following: "By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems." A similar commitment was further made under the **SDG 15.9**, which states committed to "By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts", although this only applies to the context of terrestrial ecosystems, not marine ones. Other CBD Aichi Targets that refer to 'ecosystem services' include: **target 11** (Protected areas, including MPAs, to conserve biodiversity and ecosystem services), 14 (restoring and safeguarding ecosystems that provide essential services) and 15 (carbon stocks).[168] All of which still require enhanced implementation in order to meet the 2020 deadline. With respect to target 11, there is still a lack of clarity on which ecosystem services should be prioritised when selecting areas for conservation through MPAs and other effective area-based measures. In some cases, trade-offs between conserving these areas (for ES) and conserving areas important for biodiversity may occur. Progress in achieving this component of target 11 could not been assessed to date due to insufficient information received by the CBD Secretariat,[169] which might reflect the need for further implementation guidance. The Nature Conservancy is attempting to partially address this in its Mapping Ocean Wealth project,[170] which aims at describing (quantitatively) and mapping in multiple scales the services and benefits provided by coastal and marine ecosystems such as coral reefs, mangroves and shellfish reefs, among others.

Progress towards Aichi target 2 has also been insufficient and that at the current pace it will not be achieved in time. It also notes that it is unclear if the incorporation of biodiversity values have been actually taken into consideration.[171] In this connection, a recent expert workshop on natural capital led by WWF and the French Minister of Foreign Affairs, concluded that the main challenges to further implementation of natural capital and ecosystem accounting relate to policy and institutional constraints, as well as capacity, technical knowledge and resources.[172]

It should also be noted that in addition to ecosystem services, the term "ecosystem functions"[173] has been emphasized in the context of CBD processes and the 2012 IPBES assessments.[174] Such an explicit reference in CBD decisions of 'ecosystem function' might indicate that CBD parties understand ecosystem function to be excluded from the scope of 'ecosystem service', or it could indicate an intention to emphasise the importance of such ecological processes and features as a precondition of ecosystem services themselves. The issue seems to be controversial, or at least confus-

[164] TEEB, online: <www.teebweb.org>
[165] TEEB, History & Background, online: <http://www.teebweb.org/about/the-initiative/>
[166] CBD, Decision IX/11, Para. 2.
[167] CBD, Decision IX/11.
[168] CBD, Decision X/2.
[169] CBD Secretariat, (2014), supra note 87.
[170] TNC, Mapping Ocean Wealth, online: <http://oceanwealth.org>
[171] CBD Secretariat (2014), supra note 87.
[172] WWF, *Report from the International Workshop On Opportunities and Obstacles for Natural Capital Accounting* (2015), at 5.
[173] CBD, Decision X/2, Aichi Biodiversity Targets 8, 10, 19.
[174] Resolution on the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2012), Appendix I, Para. 17.

ing, as indicated by a bracketed text of the resolution that established IPBES around the definition of terms, where both terms are defined.[175]

Despite insufficient clarity, it seems indisputable that biodiversity underpins ecosystem functions. As observed by Schimitz: "Since ecological functions derive from biotic species that comprise ecosystems, one would accordingly expect that the level of those functions is related to the level of biotic diversity (biodiversity) within ecosystems."[176] Equally, it seems indisputable that ecosystem functions in turn underpin ecosystem services.

As noted above, the UN World Oceans Assessment has dedicated several chapters to the notion of ecosystem services. It is expected that the IPBES study on oceans and coasts due by late 2017/early 2018 will draw upon the WOA's assessment and further explore the linkages between marine biodiversity and ecosystem services for further policy development. **It would be useful if IPBES could also focus on the gaps and constraints identified in the WOA and the GBO4 with respect to implementation, including on how to better overcome difficulties in integrating intrinsic values of marine biodiversity (especially in under-represented areas such as the deep-sea and connectivity across different biomes and ecosystems), supporting, regulating and cultural ES**. **Other challenges that would benefit from further analysis include building institutional and ecological scientific capabilities for secure and sustainable livelihoods and wellbeing. In addition, mapping marine ES beneficiaries across scales - from local to global levels, to better inform the development of more equitable policies, or the operationalization of existing ones would add significant value to the international policy on ES.**

C. Scholarship on Ecosystem Services in the marine context

In light of the policy developments addressed above, this section will first provide a snapshot of relevant literature on ecosystem services approaches, **assessing the extent to which the concepts described in the previous section, namely the ecosystem approach, and more specifically EAF (fisheries), are presented in the general literature on ecosystem services.**

While the scholarship on ecosystem services started in the 1960s, it was Costanza et al's 1997 landmark paper that integrated the concept into the mainstream literature and influenced international policy making (as described in section (B) supra). Costanza et al estimated the economic value of the Earth to be in an average of US$ 33 trillion per year, in contrast with the global gross domestic product (GDP), which at the time was US$ 18 trillion per year.[177] Despite the comparison with the global GDP, the authors recognized that some ecosystem services are irreplaceable, which made trade-offs technically impossible. The comparison serves to highlight that if all ecosystem services were paid for, the price of goods would be much higher. The study concludes that if all ecosystem services (including those which are perceived to be 'free' in many

[175] "[(a) "Ecosystem services" means the benefits that people obtain from ecosystems. These include provisioning services such as food, water, timber, and fibre; regulating services, such as the regulation of climate, floods, disease, waste and water quality; cultural services, such as recreation, aesthetic enjoyment and spiritual fulfilment; and supporting services, such as soil formation, photosynthesis and nutrient cycling.

(b) "Ecosystem functions" means a subset of the interactions between ecosystem structure and processes that underpin the capacity of an ecosystem to provide benefits.]" (IPBES Resolution, Annex I, para 26.)

[176] OJ Schmitz, "Perspectives on Sustainability of Ecosystem Services and Functions" in TE Graedel, E van der Voet, *Linkages of Sustainability* (MIT press Scholarship Online 2013) 33-45, at 34.

[177] R Costanza, R d'Arge, R de Groot, S Farber, et al, "The Value of the World's Ecosystem Services and Natural Capital" (1997) 387 Nature 253 – 260. See also R Costanza, R de Groot, et al, "Changes in Global Value of Ecosystem Services" (2014) 26 Global Environmental Change 152-158. Costanza et al (2014) paper updates the 1997 estimates, with current figures being approximately US $ 125 trillion/year, and calculates the losses in ecosystem services being between US$4.3 trillion/year and US $20.2 trillion/year due to changes in land use between 1997 and 2011.

places, such as water) are not given due consideration in decision-making, human welfare will suffer dramatic consequences.[178]

Constanza's study has attracted both praises and criticisms. Some perceived this approach and narrative as an opportunity to convince governments about the economic benefits of conservation, and that the costs of inaction (not-conserving) may be higher than the costs of conservation measures. Critics, on the other hand, underscored that the economic values attributed by Constanza et al are so high that it becomes difficult to translate them into meaningful policy instruments. Criticisms also included the notion of valuation as a means for privatization or commodification of ecosystem services – a notion that Costanza et al refuse on the basis that most ecosystem services are public goods or common assets that cannot be appropriated.[179]

A plethora of different and often divergent approaches and conceptualisations around biodiversity and ecosystem services (mostly for terrestrial ecosystems) have emerged in the literature, which suggests **a single, coherent ES framework is currently lacking**.[180] While deep-ecologists seem to reinforce the notion of intrinsic value of biodiversity, conservation biologists underscore the importance of biodiversity as a life-supporting system for the planet and humanity, and economists focus on natural capital and accounting and PES.[181] Furthermore, different ES definitions also result in different emphases on particular aspects of ecosystem services, such as their functional role, their utilitarian aspects, or their health and well-being values.[182] Arguably, these different emphases were incorporated in the Aichi Biodiversity Targets, and reflected in the work of the IPBES[183] as discussed in the previous section.

Ecosystem services and natural capital accounting mechanisms to date have **tended to focus on local contexts**,[184] **although literature on transboundary ecosystems, where regional and global-level beneficiaries have been identified, has started to emerge**.[185] **This means that most of the ecosystem services literature is helpful to explore intra-State dimensions of equity and fairness, and only little research is available to contextualise ES from an inter-state dimension. This imbalance also indicates that it may be difficult at this stage to rely on the ecosystem services literature to better understand ES flows from the local to the global level and vice versa, which, as discussed above, appears an essential task in the case of sustainable fisheries.**

With specific regard to marine and coastal ES, Liquete et al's literature review indicates that **food provision (particularly fisheries) is the most analysed ecosystem service,** and suggests that the **main indicator gaps in marine and coastal ecosystem services are related to the "capacity for provisioning and cultural services, benefit for regulating and maintenance services, and service flow in all categories**."[186] This seems to emphasise the difficulties or limitations of an ES framework with respect to subjective elements such as cultural services, as well as not fully understood marine ecological processes and functions. But, as duly noted by Mace et al, **these underpinning processes cannot be ignored because these same processes are vulner-**

[178] R Costanza et al (1997), ibid.
[179] R Costanza et al (2014) supra note 177.
[180] Lele (2011), supra note 131.
[181] Ibid.
[182] WOA (2016), supra note 68, Part III, Ch 3, at 4.
[183] IPBES, online: <http://www.ipbes.net/index.php/about-ipbes>; See also Lele (2011), supra note 131.
[184] Nonetheless, the EU has started to put in place a number of initiatives and mechanisms on natural accounting such as Mapping and Assessment of Ecosystems and their Services (MAES) initiative, EEA Ecosystem Capital Accounts; Regulation (EU) 691/2011, among others.
[185] See UR Sumaila, V Vats, W Swartz, *Values from the Resources of the Sargasso Sea*. (Sargasso Sea Alliance Science Report Series, No. 12, 2013); C Armstrong, NS Foley, V Kahui, A Grehan. "Cold water coral reef management from an ecosystem service perspective." (2014) 50 *Marine Policy* 126-134; L Pendleton, F Krowicki, P Strosser, J Hallett-Murdoch, *Assessing the Economic Contribution of Marine and Coastal Ecosystem Services in the Sargasso Sea.* NI R 14-05. (Duke University, 2014). See also BOBLME, *Assessing, Demonstrating and Capturing the Economic Value of Marine & Coastal Ecosystem Services in the Bay of Bengal Large Marine Ecosystem* (BOBLME-2014-Socioec-02, 2014).
[186] Liquete et al (2013), supra note 127, at 13.

able to change and have their own sustainability thresholds.[187] Scientific uncertainty relating to ecological processes and ecosystem function thus represent a constraint to valuation; or in other words, valuation techniques seem unable to properly reflect systems and processes that are not currently completely understood.

In terms of **fisheries as a provisioning service,** the most relevant indicators for this service found in literature relates to: abundance and biomass of commercial stocks and food-web structure; catches and landings; and monetary benefits derived from fisheries (market prices), jobs, as well as community dependence on the fishery. [188] But even in this better studied area, most studies focus on coastal habitats such as mangroves and wetlands, with **the deep sea and high seas being significantly underrepresented. Insufficient research on the connectivity between coastal and open-ocean, pelagic and deep-sea systems also pose a constraint in advancing ES in the marine realm**. One of the few recent study focusing on the high seas concluded that high seas fisheries accounts for more than US$16 billion in gross landed value per year (estimated 10 million tons of fish), and **given the straddling nature of most of these stocks, overfishing on the high seas are negatively affecting fishing catches in coastal waters.** [189]

Despite such recent progress made in the field of deep sea and high seas valuation,[190] due to the difficulties in valuating **supporting services** (to avoid double-counting) and the difficult access to these areas (e.g. limited tourism, etc), the **'willingness to pay' methodology** has been chosen in some studies regarding cold water corals.[191] Despite being a widely accepted valuation methodology in general terms, it is debatable whether willingness to pay can properly reflect the values of important structure-forming species to ecosystem structure, function, and even productivity. In this light, some authors have duly argued that supporting services should be counted as 'stocks' and not merely as 'flows'.[192] In addition, the lack of consistency in the elaboration of ecosystem services indicators or valuation methodologies can lead to subjectivity that might not correspond to the supporting capacity of the ecosystem in question. As noted by Liquete et al, "valuing this complex ecological service [life cycle maintenance] through willingness-to-pay or other stated preferences' techniques that do not necessarily correlate with benefit or utility can be misleading."[193]

Recognising these scientific uncertainties and methodological limitations, Pendleton et al have suggested a new approach for assessing the value of marine ecosystems services in the Sargasso Sea, that focuses on key ecological processes and habitats (or intermediate service).[194,195] The authors note that:

> "Some ecosystem services in the Sargasso Sea may be harvested directly (e.g., fish or seaweed). In other cases, ecosystem functions provided by the Sargasso Sea may act as only an intermediate element in the production of ecosystem services, for instance when *Sargassum* supports part of the life cycle of organisms that ultimately benefit people far from the region (e.g., eels spawned in the Sargasso Sea are harvested in North America and Europe). The Sargasso Sea ecosystem is part of larger oceanic processes whose ecological and environmental outcomes

[187] Mace et al (2012), supra note 124, at 21. See also E Garmendia, U Pascual, "A Justice Critique of Environmental Valuation for Ecosystem Governance" in T Sikor (Ed), *The Justices and Injustices of Ecosystem Services* (Earthscan/Routledge 2013) 161-186, at 171.

[188] Liquete et al (2013), supra note 127.

[189] AD Rogers, UR Sumaila, SS Hussain, C Baulcomb, *The High Seas and Us: Understanding the Value of High-Seas Ecosystems* (Global Ocean Commission, 2015).

[190] See Ibid; C Armstrong, et al (2014), supra note 185.

[191] M Aanesen, C Armstrong, M Czajkowski, J Falk-Petersen, N Hanley, S Navrud. "Willingness to Pay for Unfamiliar Public Goods: Preserving Cold-Water Coral in Norway." (2015) 112 *Ecological Economics* 53-67.

[192] C Armstrong (2014) supra note 185.

[193] Liquete et al (2013), supra note 127, at 10.

[194] L Pendleton, F Krowicki, P Strosser, J Hallett-Murdoch, *Assessing the Economic Contribution of Marine and Coastal Ecosystem Services in the Sargasso Sea.* NI R 14-05. (Duke University, 2014).

[195] The Sargasso Sea has been described as an area that meets the CBD Ecologically or Biologically Significant Marine Areas criteria. (CBD Decision XI/17 (2012))

may affect human wellbeing globally (e.g., carbon sequestration)."[196]

The authors nevertheless acknowledge that this valuation is incomplete, as it only looks into a few "quantifiable ecosystem services that depend, in part or as a whole, on the Sargasso Sea ecosystem".[197] However, considering "intermediary services" and **the identification of beneficiaries at a regional and global levels can contribute to more equitable management of that ecosystem through enhanced inter-state cooperation.** What is not clear is how the values themselves could contribute to anything besides informing trade-offs. For instance, would the EU exert any pressure on those states disturbing the eel spawning grounds on the Sargasso Sea? Or would the beneficiaries pay for the necessary measures to protect that habitat including with respect to monitoring/enforcement measures? Perhaps, simply knowing the estimated value of a given habitat may contribute to enhanced cooperation by States to minimise the anthropogenic impacts in the area, especially when multiple beneficiaries are identified. It would be interesting to investigate how these benefits are distributed within states as well for a more comprehensive picture. These reflections link to a general point made by Adams: "it is not enough to identify the net benefits of ecosystem services: It also matters who gets them"[198] as these unequal patterns of access to ecosystem services can lead to conflicts and ecosystem degradation.[199]

D. Evaluation of the state of the art on marine ecosystem services

Overall, it can be stated that **the ES concept/framework is still evolving and is at its early stages with specific regard to marine ecosystems.** Insufficient data availability and scientific uncertainties over ecosystem functioning and integrity contribute to this late start in comparison with terrestrial ecosystems. **A better understanding of marine supporting, regulating and cultural services, in particular, is essential not only for the realization of the full potential of the ES concept(s) towards human wellbeing, but also for the implementation of the ecosystem approach**, which comprises a much broader framework for long-term sustainability**.**

In addition, **given the transboundary nature of marine systems, the tendency in ES scholarship to focus exclusively on local contexts[200] and the merely incipient state of the literature on ecosystem services in the deep seas and on transboundary ecosystems seem to indicate that it may be difficult at this stage to understand ES flows from the local to the global level and vice versa, which, as discussed above, appears an essential task in the case of sustainable fisheries. This in turn seems to stand in the way of better understanding ES beneficiaries at local, regional and global levels, which is necessary to identify and address equity issues in relation to sustainable fisheries.**

Finally, the **ES framework faces criticisms concerning the absence of proper integration of fairness and equity**, including long-term sustainability due to oversimplification and omissions regarding the relationship between the environment (and environmental processes and services) and society.[201] Despite its original intent to give nature a voice and providing more transparent and informed decision-making conditions for governments, it thus remains to be seen whether the ES framework can help address the underlying causes of biodiversity loss, while addressing sustainability and equity, in the context of fisheries management. The next section focuses on different aspects of sustainability and equity that can be linked to the multiple dimensions of poverty associated with small-scale fishing, with a view to

[196] L Pendleton et al (2014) supra note 194.
[197] Ibid.
[198] B Adams, "The Value of Valuing Nature" (2014), 346 (6209) Science 549-551, at 550-1.
[199] Ibid, at 551.

[200] Nonetheless, the EU has started to put in place a number of initiatives and mechanisms on natural accounting such as Mapping and Assessment of Ecosystems and their Services (MAES) initiative, EEA Ecosystem Capital Accounts; Regulation (EU) 691/2011, among others.
[201] Lele (2011), supra note 131.

refining the identification of legal questions that will be pursued in the next phase of this project.

4. Poverty Alleviation

This section aims at underlining the linkages between poverty alleviation in the context of small-scale fisheries and their relevance for an ecosystem approach to fisheries and marine ecosystem services. It is important to note, on the one hand, **the difficulties associated with valuing the underpinning ecological processes that guarantee provisioning service such as seafood, and on the other hand the multiple dimensions of poverty that are not only related to food and jobs**. **Thus, a holistic approach is needed to answer the question of how the ES concept(s) might contribute to poverty alleviation in a small-scale fisheries context.** This is the reason why this project proposed to examine whether the ecosystem approach and fair and equitable benefit-sharing may assist in taking such a holistic approach.

A. The different dimensions of poverty and the linkages between poverty alleviation and marine ecosystem services/benefits

The definition of poverty and its measurement has evolved throughout the years, and now incorporates not only low income and consumption, but also basic needs (food, health, sanitation), human rights and a sense of inclusiveness and security.[202] With specific regard to fisheries, Allison and Horemans underscore that:

> "The multi-dimensional nature of poverty and the relationship between poverty, vulnerability and social exclusion in fishing communities is increasingly acknowledged. Townsley observes that ''fishing communities are often characterised by overcrowded living conditions and inadequate services, low levels of education and a lack of skills and assets (particularly land)'', and FAO emphasises that some fishers ''live in remote and isolated communities, are poorly organised and politically voiceless and often highly exposed to accidents and natural disasters''[203]

Due to this multi-dimensional nature and different stressors and causes, solutions to poverty in small-scale fisheries depend on multiple solutions from a range of different sources, within, but also beyond, fisheries governance systems in a strict sense (i.e, enhanced access to education, health, access to land in addition to fishing resources at sea, and improved social policies).[204] So, based on this complex understanding, could the ES framework contribute to poverty alleviation? In a recent literature review, Suich et al concludes that **most studies on ecosystem services only focus on income rather than the multiple dimensions of poverty, and most of the papers focused on a single ecosystem service.**[205] Furthermore, from all the papers analysed, none covered marine ecosystems. The authors conclude that "… there is still a poor understanding of ecosystem-based pathways out of poverty, if indeed they exist."[206]

Beyond the ES literature, however, an extensive body of literature exists on the human dimensions of small-scale fisheries including poverty considerations. In effect, Jentoft and Midre argue that access to fisheries resources is crucial to livelihood security.[207] As also noted in the WOA, "[t]he contribution of

[202] EH Allison, B Horemans, "Putting the Principles of the Sustainable Livelihoods Approach into Fisheries Development Policy and Practice" (2006) 30 Marine Policy 757-766.
[203] Ibid, at 758.
[204] Ibid.
[205] H Suich, C Howe, G Mace, "Ecosystem Services and Poverty Alleviation: A Review of the Empirical Links", (2015) 12 Ecosystem Services 137-147.
[206] Ibid, at 144.
[207] S Jentoft, G Midré, "The Meaning of Poverty: Conceptual Issues in Small-Scale Fisheries Research" in S Jentoft, A Eide (eds), *Poverty Mosaics: Realities and Prospects in Small-Scale Fisheries* (Springer, 2011), 43-68.

small-scale fisheries has been increasingly recognized as a major factor for food security and livelihoods at household and community levels, particularly for poor communities around the world".[208]

However, **access to resources** raised a number of other complexities, including with respect to use conflicts with large-scale fisheries, such as those from distant-water fleets fishing the 'surplus' on the basis of bilateral fisheries access agreements; access to resources that have not been depleted by large-scale operations (or a right to a healthy and productive marine environment); landing rights issues,[209] fishery resource allocation by site,[210] and sustainability of the resource, among others. Therefore, an investigation of the interface between biodiversity conservation (and associated ecosystem services) and poverty reduction would benefit from considering these issues towards more secure livelihoods.

Another related area that deserves further in-depth attention concerns the obligation of states to follow scientific advice in decision-making with regards to total allowable catches, habitat and biodiversity protection (key components of UNCLOS and UNFSA), which still lack wide-spread implementation for political and economic reasons.[211] **Conflicts between specific scientific advice and livelihoods** might emerge, despite the need to recognise the carrying capacity of ecosystems. Some communities are more dependant on the resources than others, therefore catch restrictions can push these communities into deeper poverty levels and increased marginalisation. However, this issue cannot be disassociated from **use conflicts with industrial fisheries or destructive fishing methods**: a number of case studies suggest that after the introduction of trawling in certain regions, small-scale fishing communities became more impoverished.[212]

Furthermore, **capacity building[213] and technology transfer**[214] can also contribute to poverty alleviation in developing countries,[215] as these can result in appropriate and more participatory conservation and management measures, and enhanced monitoring, control and surveillance to avoid illegal, unreported and unregulated (IUU) fishing.[216] This can also support improved and accurate catch data reporting (including for artisanal fisheries), which in turn will help operationalise EAF and set precautionary reference points according to UNFSA.[217] Catch data is a fundamental component for stock assessments and establishment of sustainable total allowable catch limits and rebuilding plans. It has been estimated that more than 80% of the global catch comes from stocks that have not been formally assessed,[218] leading to over-exploitation of the resources and consequently to unsecure livelihoods.

B. Ecosystem services and poverty alleviation in key policy instruments: direct connections

Some of the linkages identified above find reflection in international policy instruments. As early as 2004, CBD Parties recalled that the World Summit on Sustainable Development recognised the ecosystem approach as an important instrument for poverty alleviation, and provided recommendations around equity and participation, and adaptive management to address critical needs such as poverty.[219] In

[208] WOA (2016), Part IV, Ch 15, at 1.
[209] M Banvick, "Wealth, Poverty and Immigration: The Role of Institutions in the Fisheries of Tamil Nadu, India" in S Jentoft, A Eide (eds), supra note 207, 173-191.
[210] WOA (2016), Part IV, Ch 15.
[211] see A/CONF.210/2010/7, para 75.
[212] See Jentoft, Midré (2011), supra note 207.
[213] See also *Chennai Guidance for the Integration of Biodiversity and Poverty Eradication*, CBD Decision XII/5, Annex, para. 3; See also WOA (2016), Part V, ch 32, and Part VI, ch 53.
[214] As per SDG target 14.a, UNCLOS, UNFSA.
[215] A/CONF.210/2010/7, para. 43. But see Jentoft, Midré (2011), supra note 207, on the concept of "poverty trap".
[216] See SM Glaser, PM Roberts, RH Mazurek, KJ Hurlburt, L Kane-Hartnett, *Securing Somali Fisheries*. (One Earth Future Foundation, 2015).
[217] See section 2 supra.
[218] Rosenberg et al (2014), supra note 110; C Costello, et al, "Status and Solutions for the World's Unassessed Fisheries" (2012), 338 (6106) *Science* 517–520.
[219] CBD, COP VII/11, Annex I, para 1.

2014, CBD Parties recognised "the need for increased capacity for mainstreaming biodiversity and ecosystem services into poverty eradication",[220] and encouraged "… to integrate biodiversity and nature's benefits to people, including ecosystem services and functions, into poverty eradication and development strategies, initiatives and processes at all levels, and vice versa …"[221]

In this connection, CBD Parties also welcomed the ***Chennai Guidance for the Integration of Biodiversity and Poverty Eradication***.[222] These voluntary guidelines encourage governments to integrate biodiversity and ecosystem functions and services concerns into national development strategies and national accounting systems reinforcing Aichi Target 2. They also encourage the implementation of mechanisms to avoid negative impacts on customary use and access to biological resources enjoyed by communities, in accordance with national legislation.[223] Furthermore, the Chennai Guidance encourages:

> "… the understanding and implementing of the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security issued by the Food and Agriculture Organization of the United Nations to promote secure tenure rights and equitable access to land, fisheries and forests as a means of eradicating hunger and poverty, supporting sustainable development and enhancing the environment".[224]

It should thus be recalled that the FAO Small-scale Fisheries Guidelines were developed on the basis of the Tenure Governance Guidelines. **The linkage established between biodiversity mainstreaming (including in the fisheries sector) and resource tenure security serves to emphasize the law-related dimensions of poverty alleviation**. In this context, note also that the Chennai Guidance pays special attention to certain groups including indigenous and local communities, smallholders, especially woman, the poor, marginalised and vulnerable people, and aims at improving their long-term livelihoods while avoiding adverse impacts on biodiversity and ecosystem integrity.

The link between poverty reduction and the ecosystem approach to fisheries more specifically has also been recognised in international policy documents. The FAO Technical Guidelines for Responsible Fisheries recognises that: "Introducing EAF in developing countries with limited capacities may prove particularly challenging. **Special care is needed when designing and implementing EAF in a poverty context** in order to ensure participatory processes and equitable outcomes."[225]

C. Preliminary thoughts on the nexus between poverty alleviation and the ecosystem approach to fisheries, in the context of Human Rights

As highlighted in previous sections, the FAO SSF Guidelines[226] are an important instrument to be analysed in the context of poverty alleviation. SSF is in fact perceived as a way out of poverty.[227] For instance,

> "…compared to agriculture, there is significant labour absorption in the related upstream (input supplies for harvesting) and downstream economic activities (post-harvest and marketing), making small- scale fisheries a strong driver for poverty reduction, particularly in more remote, rural and coastal locations. The returns to labour in the small-scale fishery, particularly due to

[220] CBD, Decision XII/5, preambular paragraph.
[221] Ibid, para 3.
[222] Ibid, para 2 and Annex I.
[223] Ibid, Annex, Para 2 (a) (ii).
[224] Ibid, Annex, Para. 2 (b).
[225] FAO, Fisheries Management: The Ecosystem Approach to Fisheries: Human Dimensions of the Ecosystem Approach to Fisheries (*FAO Technical Guidelines for Responsible Fisheries*. No. 4, Suppl. 2, Add. 2, 2009), at xvii.
[226] And the interface between these Guidelines with the FAO Voluntary Guidelines to Support the Progressive Realization of the Right to Adequate Food in the context of National Food Security; and with the FAO Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security.
[227] Bené, Hersoug, Allison (2010), supra note 7.

> the prevalent income-sharing mechanisms (rather than wage) which it adopts, are significant. Their contributions to rural development can therefore be significant, though not adequately recognized and accounted for in formal state economic accounting formats"[228]

Thus, besides aiming at the enhancement of the contribution of small-scale fisheries to global food security and nutrition and at responsible fisheries, the FAO SFF Guidelines have among their objectives the realisation of the right to adequate food, the equitable development of small-scale fishing communities, poverty eradication and the improvement of the socio-economic conditions of fishers in sustainable fisheries management. To realize these objectives, **the Guidelines include several principles that can be related to the multiple dimensions of poverty, namely: human rights and dignity; equity and equality; consultation and participation; transparency; economic, social and environmental sustainability; and holistic and integrated approaches**.

Human rights and human rights-based approach are evoked throughout the Guidelines, which recognise the right of small-scale fishing communities, including indigenous peoples, to livelihood, particularly of the vulnerable and marginalised groups, and the corollary need for access to fisheries resources. Specific reference to human rights characteristics such as universality and inalienability, non-discrimination, inclusion, accountability and the rule of law is also provided. The recognition of such rights is not only due by states, but also by business enterprises, which in turn should be regulated by states to ensure compliance with these human rights standards.

International law on human rights therefore appears relevant to analyse the ecosystem approach to fisheries and corresponding institutional reform as a cross-cutting line of intervention and for its potential to break the "poverty trap" and related inequalities that characterize the current system, while recognising the challenges created by power imbalances and the dynamics of inequality.[229]

In effect, even though **the SSF Guidelines do not refer to ecosystem services per se, they evoke the ecosystem approach and the importance of healthy ecosystems as a necessary condition for sustainable livelihoods**. In addition, the Guidelines make reference to benefit-sharing, which – as discussed above – can be seen as part of the ecosystem approach. Specifically, the Guidelines support the **equitable distribution of the benefits yielded from the responsible management of fisheries and ecosystems**, with a particular view to rewarding small-scale fishers and fish workers, in connection with their social and cultural wellbeing, their livelihoods and sustainable development.[230]

This appears motivated by the fact that customary practices for the sharing of resource benefits in small-scale fisheries, which have been in place for generations, have been changed in various ways. For example, a result of non-participatory and often centralized fisheries management systems, rapid technological developments, and through unequal power relations particularly when large-scale fishing or other sectors such as tourism, agriculture, mining or infrastructure development is at stake. The SSF Guidelines further point to the need for preferential treatment of women, indigenous peoples and marginalized groups where it is required to ensure equitable benefits.

In this context, benefit-sharing may lead to access to resources and markets, as per SDG target 14.b, as well as enhanced participation in decision-making in light of different dimensions of environmental justice (distribution, recognition, participation, capabilities).[231] In addition, whether and how property rights[232] or rights-based management – a much promised avenue for social and environmental justice -

[228] KL Cochrane, SM Garcia (2009) supra note 103, at 408.

[229] T Piketty, "Putting Distribution Back at the Center of Economics: Reflections on *Capital in the Twenty-First Century"* (2015) 29 (1) Journal of Economic Perspectives 67-88.

[230] FAO SSF Guidelines, para 5.1.

might lead to the fair and equitable sharing of benefits remains to be explored.[233]

For these reasons, **an international human rights law lens appears necessary to examine the nexus between the ecosystem approach to fisheries, including benefit-sharing, and multiple dimensions of poverty (food, health, access to resources, participation, non-discrimination)**, with a view to assessing whether the ecosystem services framework can provide an avenue for the full implementation of the ecosystem approach with particular attention to small-scale fishermen.

5. Conclusions and entry points for a legal analysis on marine ecosystem services and poverty alleviation

This 'science-policy' report has made the point that due to the importance of marine biodiversity for ecosystem structure, function and productivity, and the current rate of biodiversity loss, there is an urgent need for the adoption of conservation and management measures that consider the holistic characteristics of the marine environment. The **ecosystem approach** to fisheries is intended to offer such a comprehensive approach that incorporates a number of principles (such as the precautionary approach and equity) applicable in relation to biogeographic units and subunits and tools (e.g. impact assessment, habitat protection, selective methods to avoid bycatch, multi-species modelling, assessment of productivity capacity, procedural participation mechanisms, etc). The ecosystem approach also aims to respect the production limit of the ecosystem in question to avoid its depletion (maintaining the integrity of natural capital so 'ecological interest' can be accrued).

However, how are the benefits derived from the application of an ecosystem approach to fisheries (maintained healthy stocks and recovered depleting ones) supposed to be shared? In this connection, this report has highlighted that the ecosystem approach, at least as conceptualized under the CBD, includes the concept of **fair and equitable benefit-sharing** to reward ecosystem stewards. The same concept can be found in the FAO Small-scale Fisheries Guidelines, with a particular view to rewarding small-scale fishers and fish workers, in connection with their social and cultural wellbeing, their livelihoods and sustainable development.

Against this background, the **ecosystem services framework and concept(s) appear narrower than the ecosystem approach**. The ES framework has raised concerns as to whether ecosystem functions are adequately seen as a precondition for ecosystem services themselves, and does not necessarily include an investigation of equity and justice issues (especially when considering wellbeing and poverty in all their distinct forms and dimensions). Furthermore, the ES framework appears unable to properly reflect ecological processes and functions that are still not fully understood. In addition, the ES framework does not go beyond identifying the net benefits of ecosystem services, and does not enter into questions of unequal access to ecosystem service benefits, and who gets these benefits - questions which are linked to prevailing patterns of wealth and power, transparency and secure resource tenure. With this in mind, it has also been noted that the ES framework is just beginning to tangibly address subjective elements such as cultural services.

Finally, the ES framework has paid limited attention to understanding the ways in which ecosystem services actually do contribute to poverty alleviation, generally focusing on income rather than on multiple dimensions of poverty (food security and nutrition, health, assets, education and skills, property rights, etc). In particular, research on marine ecosystem services has been more developed in the areas of fisheries as a food- (and nutrition-) provisioning service, but not to other contributions to

poverty alleviation. A number of other dimensions of poverty have yet to be considered, for example: access to fisheries resources, conflicts between large-scale and small-scale fisheries, and the implementation of sound conservation and management fisheries and biodiversity related measures to ensure long-term sustainability of the resources and secure livelihoods.

The mismatch and potential synergies between the ES framework(s) and the ecosystem approach to fisheries will be further investigated in the next phase of the Marine Benefits project through an analysis of the opportunities and constraints in **international environmental law** and **international law of the sea** (treaties and soft-law instruments such as the SDGs, the FAO SSF Guidelines, CBD Decisions and UNGA resolutions). This will clarify how the three pillars of sustainability can be integrated towards the achievement of an ecosystem approach with particular attention to small-scale fishermen. In addition, as this current report has highlighted that the connection between the ecosystem approach to fisheries, including benefit-sharing, and the multiple dimensions of poverty rests also on **human rights**, the legal analysis will also draw on that body of international law to explore opportunities and constraints vis-a-vis environmental justice (distribution, recognition, participation, capabilities) and poverty alleviation for small-scale fishing communities.

All these entry-points for legal analysis can be brought under the umbrella of **intra-State benefit-sharing** with small-scale fishing communities (questions related to property rights, access to markets, participation in decision-making, community-based management, etc). But this is only part of the picture. There are several complementary, necessary questions around **inter-State** benefit-sharing.

First, how can developing states with limited capabilities implement the ecosystem approach to fisheries, as a precondition for that approach to contribute to poverty alleviation? This raises questions related to how the implementation of international obligations (in the international law of the sea and international environmental law) on **scientific, financial, technological and capacity-building cooperation** among states (that can be seen as forms of inter-State benefit-sharing[234]) can have implications for developing countries seeking to rely on the ecosystem approach to fisheries to alleviate poverty. These challenges are aggravated by unsustainable fishing practices, including IUU fishing practices on the high seas and in developing countries' waters, which result in the depletion of resources and other associated ecosystem services, and which depend on effective international cooperation. [235]

Second, **biodiversity conservation tools** that rely on inter-State cooperation such as the description of EBSAs and the identification of VMEs may provide benefits to small-scale fisherfolk and livelihoods, including through capacity building and technology transfer opportunities, in addition to the ecological benefits that derive from the eventual adoption of equitable and science-based (including through the incorporation of traditional knowledge) conservation and management measures. Another important tool that should be further explored in the context of conservation and sustainable use of marine resources (including natural capital, supporting and regulating services) in connection with poverty alleviation is the use of **EIAs** prior to granting industrial fishing licenses (in accordance with UNFSA, Art. 5 (d) for both national and distant-water fleets within and beyond national jurisdiction). In this context **it might be worth exploring further how existent EIA criteria/standards and lessons learned (e.g. in assessing significant adverse impacts on VMEs and areas of biodiversity and ecological importance such as EBSAs) could help reduce environmental and social injustices including by safeguarding ecosystem functions, productivity and resilience. This would also entail further analysis of State obligations to cooperate on the conservation of marine living resources and biodiversity in areas beyond**

[234] E Morgera (2015), supra note 2.

[235] At 2012 UN Conference on Sustainable Development ("Rio+20") States committed to cooperating with developing countries to identify needs and build capacity systematically, including support for monitoring, control, surveillance, compliance, and enforcement systems to combat IUU fishing (The Future We Want, para 170).

national jurisdiction. Furthermore, if minimal standards for EIAs are to be adopted with regard to industrial fisheries in developing States, capacity building and technology transfer would be necessary in this connection too.

Third, how do inter-State relations affect access to fishing resources in ways that trickle down to small-scale fishermen? Major concerns from developing countries include inequitable **access to marine living resources**, given the discriminatory quota allocation between old and new **RFMOs** members,[236] and unsustainable fishing carried out under **bilateral fisheries access agreements** to the detriment of small-scale fishermen.[237]

With regards to the latter, an analysis of whether and how fisheries access agreements[238] could provide a fair and equitable benefit-sharing mechanism for developing countries to the advantage of small-scale fishing communities rather than contributing to their further impoverishment would add value to the ecosystem services literature.[239] This issue is inter-linked with the concept of fisheries surplus and how the allowable catch is calculated (e.g. having MSY as a target (UNCLOS) or as a limit (precautionary approach, UNFSA). As noted in section 2 supra, in addition to adopting maximum sustainable yield as a fisheries management target, UNCLOS establishes that:

> "The coastal State shall determine its capacity to harvest the living resources of the exclusive economic zone. Where the coastal State does not have the capacity to harvest the entire allowable catch, it shall, through agreements or other arrangements and pursuant to the terms, conditions, laws and regulations referred to in paragraph 4, give other States access to the surplus of the allowable catch…"[240] (emphasis added)

These provisions raise a number of sustainability (and ecosystem services) related questions ultimately important for poverty alleviation in small-scale fishing communities, including:

a. The capabilities of developing states and least developed states to generate science and determine (precautionary) reference points as per the Fish Stocks Agreement (as well as the responsibility of developed states to contribute to this endeavor including through capacity building and technology transfer);
b. The adequacy of using MSY as a target despite changes in perception and evolutionary interpretation of UNCLOS in light of UNFSA and policy instruments (generally agreed standards) concerning the precautionary approach and ecosystem approach (as briefly discussed in section 2 above);
c. The ability of the ecosystems to produce surpluses; and in this connection, the utility of ecosystem and fisheries production models (see section 2 supra) as a vehicle for predicting and calculating fishery production (and corresponding provisioning services) in accordance with the precautionary and ecosystem approaches;
d. How this UNCLOS provision on surplus should be interpreted in light of other UNCLOS and UNFSA provisions which confer a differentiated treatment for developing countries and small-scale fishers;
e. Could the ES framework offer a fresher perspective in this context? For instance, could valuation of ecosystem services be reflected in the licensing prices negotiated between the coastal and the flag state? If so, a PES scheme could perhaps be designed in a way that also makes these financial resources tied to specific social and

[236] These concerns were voiced during the 2010 UN Fish Stocks Agreement Resumed Review Conference. (UNGA, A/CONF.210/2010/7, Report of the Resumed Review Conference on the Agreement for the Implementation of the Provisions of the United Nations on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UN, 2010); See also UNFSA, Art. 11.

[237] J Vogler, C Bretherton, 'The European Union as a Sustainable Development Actor: The Case of External Fisheries Policy' (2008) *Journal of European Integration* 401.

[238] See F Le Manach, et al.,"European Union's Public Fishing Access Agreements in Developing Countries" (2013) 8 (11) PLoS ONE e79899.

[239] This will be investigated in the next phase of the Marine Benefits project.

[240] UNCLOS, Art. 62 (2).

environmental programmes that support small-scale fishers and the conservation of ecological processes that sustain the health and productivity of the marine environment; and

f. The possible/desirable/necessary role of international biodiversity and human rights obligations in assessing fisheries-related ecosystem services and negotiating access to fisheries.

From a scientific perspective, it is noteworthy to highlight Longhurst's thought-provoking question:

> "If we believe that marine ecosystems really can produce a surplus of biomass of some of their component vertebrates beyond what is required to sustain their natural populations, surely we should ask what distinguishes them from terrestrial ecosystems, which do not appear to have the same capacity. If the supposed surplus production of some marine vertebrates is real, and useful to us, then we need to understand what characteristics of marine ecosystems are essential for its production." [241]

This necessary understanding seems to be incorporated by ecosystem production models (see Section 2 supra), which can help calculate more sustainable total allowable catches. Importantly, however, with the intensification of climate change and ocean acidification, predictions will become more difficult to make, requiring more precaution to safeguard the ecological processes that underpin seafood production. From a legal perspective, questions of inter-State benefit-sharing have only been rarely investigated by taking into account their implications for intra-State benefit-sharing, poverty alleviation and/or human rights. From a policy-science perspective, these global, regional and bilateral governance questions tend to be ignored by the ecosystem services literature: the ES framework(s) and natural accounting mechanisms derived from policy instruments to date have tended to focus on the intra-state benefit-sharing dimension, although literature on transboundary ecosystem services has started to emerge.

Overall, a multi-scalar analysis is needed to understand the interplay between inter- and intra-State benefit-sharing in the context of marine ecosystem services. The ultimate aim of the next phase of this project (the legal analysis) will thus be to answer the question: which enabling conditions are necessary for the realisation of fair and equitable benefit-sharing from sustainable fishing at all levels of governance (from global to regional and local)?

[241] Longhurst (2010), supra note 16, at 56.