

2015 GSDR - Chapter 3: The Oceans, Seas, Marine Resources and Human Well-being Nexus

Annex I: Extended version of Table 3-1: Important inter-linkages between oceans, seas, marine resources and human well-being (Extended version) –IN PROGRESS

Table 3-1: Important inter-linkages between oceans, seas, marine resources and human well-being (Extended version) –IN PROGRESS

Oceans, seas marine resources (ECOSYSTEM INTEGRITY)		
Inter-linkages	Illustrative scientific reports*	Further research areas suggested by contributing experts:
<p>Biogeochemical and physical processes</p> <p>Hosting of marine reservoirs of biodiversity</p> <p>Forming of coastal and marine habitats, including nursery grounds</p> <p>Provision of supporting services (nutrient cycling, carbon cycling/ sequestration, oxygen provision, soil formation, primary production etc.)</p> <p>Contribution of biological diversity to balance and maintenance of marine food web</p> <p>Contribution of biological diversity to overall ecosystem functioning and stability</p> <p>Atmospheric climate regulation</p>	<ul style="list-style-type: none"> • UN World Ocean Assessment (2015) • Census of Marine Life • Ocean Biogeographic Information System (OBIS) • WWF Living Planet Index <p>-----</p> <ul style="list-style-type: none"> • McCauley, D.J. et al. (2015). Marine defaunation: Animal loss in the global ocean. • National Research Council of the National Academies (2015). Sea Change: 2015-2025 Decadal Survey of Ocean Sciences. • Bates et al. (2014). Resilience and signatures of tropicalization in protected reef fish communities. • Borja (2014). Grand challenges in marine ecosystems ecology. • Britten et al. (2014). Predator decline leads to decreased stability in a coastal fish community. • Edgar et al. (2014). Global conservation outcomes depend on marine protected areas with five key features. • FAO (2014). The State of World Fisheries and Aquaculture - Opportunities and Challenges. • Galparsoro et al. (2014). Mapping ecosystem services provided by benthic habitats in the European North Atlantic Ocean. • Gamfeldt et al. (2014). Marine biodiversity and ecosystem functioning: what's known and what's next? • Glaser M. and Glaeser B. (2014). Towards a framework for cross-scale and multi-level analysis of coastal and marine social-ecological systems dynamics. • IPCC (2014). Climate Change 2014: Impacts, Adaptation, and Vulnerability. Chapter 6. Ocean Systems. • Jackson et al. (2014). Status and Trends of Caribbean Coral Reefs: 1970-2012 • Jiao et al. (2014). Mechanisms of microbial carbon sequestration in the ocean – future research directions. Biogeosciences, 11, 5285–5306, 2014 	<ul style="list-style-type: none"> • Assessing actual direct, indirect and cumulative impacts of human activities on marine and coastal ecosystems, including deep sea ecosystems; assess resilience of marine and coastal ecosystems • Sustainable approaches to marine aquaculture • Indirect and cumulative effects of biodiversity loss on ecosystem functioning and stability and role of keystone species • Modeling of production functions for multiple ecosystem services of critical marine habitats, especially coral and bivalve reefs, seagrass beds, mangroves and marshes • Valuing carbon storage capacity of marine ecosystems and potential to increase sequestration through habitat protection and restoration • Ecological effects of emerging activities, such as ocean energy development, ocean geo-engineering (e.g. CO₂ injection, ocean fertilization) and open ocean aquaculture • Goods and services provided by deep sea ecosystems and their real values • Biodiversity role in ecosystem functioning, stability and resilience, including the roles of genetic diversity and functional redundancy • Diversity of marine bacteria, microbes, and viruses and their role in ecosystem functioning • Influence of habitat-forming species on biodiversity throughout their range; their response to climate change and consequences for associated biodiversity; resilience of various habitat types and communities to perturbation and capacity to recover from it • Analyze how global changes interact currently and in the future with changing patterns in biodiversity and ecosystem functioning • Accelerate discovery as much biodiversity can be lost before it has been discovered • Baselines for monitoring and evaluation of biomass and/or distribution of stocks (benthic and pelagic species) • Reproduction of important marine species • Marine species lifecycle and habitats of commercially important species • Development of methodologies for assessment of marine ecosystems and open ocean • Functional links between terrestrial, coastal and marine ecosystems, and consequences of degradation on neighbouring systems

- [Leadley et al. \(2014\). Interacting regional scale regime shifts for biodiversity and ecosystem services. BioScience doi:10.1093/biosci/biu093.](#)
- [Mouillot et al. \(2014\). Functional over-redundancy and high functional vulnerability in global fish faunas on tropical reefs.](#)
- [Mumby \(2014\). Stratifying herbivore fisheries by habitat to avoid ecosystem overfishing of coral reefs. Fish and Fisheries.](#)
- [Newton et al. \(2014\) An overview of ecological status, vulnerability and future perspectives of European large shallow, semi-enclosed coastal systems, lagoons and transitional waters.](#)
- [Pikitch et al. \(2014\). The global contribution of forage fish to marine fisheries and ecosystems.](#)
- [Rickels et al. \(2014\). How healthy is the human-ocean system?](#)
- [Robinson et al. \(2014\). Jellyfish, forage fish, and the world's major fisheries.](#)
- [Secretariat of CBD \(2014\). Global Biodiversity Outlook 4.](#)
- [Stoddart, M. \(2014\). The Census of Antarctic Marine Life.](#)
- [UNEP \(2014\): Measuring Success: Indicators for the Regional Seas Conventions and Action Plans.](#)
- [Van Tussenbroek et al. \(2014\). Caribbean-Wide, Long-Term Study of Seagrass Beds Reveals Local Variations, Shifts in Community Structure and Occasional Collapse.](#)
- [Bernhardt, J.R. and H.M. Leslie \(2013\). Resilience to Climate Change in Coastal Marine Ecosystems.](#)
- [Colloca et al. \(2013\). Rebuilding Mediterranean fisheries: toward a new paradigm for ecological sustainability in single species population models.](#)
- [Costello et al. \(2013\). Global Coordination and Standardisation in Marine Biodiversity through the World Register of Marine Species \(WoRMS\) and Related Databases.](#)
- [Halpern and Fujita \(2013\). Assumptions, challenges, and future directions in cumulative impact analysis.](#)
- [Micheli et al. \(2013\). Cumulative Human Impacts on Mediterranean and Black Sea Marine Ecosystems: Assessing Current Pressures and Opportunities.](#)
- [Mouillot et al. \(2013\). Rare Species Support Vulnerable Functions in High-Diversity Ecosystems.](#)
- [Visbeck et al. \(2013\). Establishing a Sustainable Development Goal for Oceans and Coasts to](#)

[Face the Challenges for Our Future Ocean.](#)

- [Halpern et al. \(2012\). An index to assess the health and benefits of the global ocean.](#)
- [Ling, S.D. and Johnson, C.R. \(2012\). Marine reserves reduce risk of climate-driven phase shift by reinstating size- and habitat-specific trophic interactions.](#)
- [Micheli et al. \(2012\). Evidence that Marine Reserves Enhance Resilience to Climatic Impacts.](#)
- [Newton et al. \(2012\). The coastal syndromes and hotspots on the coast.](#)
- [Chin et al. \(2011\). Status of Coral Reefs of the Pacific and Outlook: 2011.](#)
- [ILEC \(2011\). Methodology for the GEF Transboundary Waters Assessment Programme. Volume 3. Methodology for the Assessment of Transboundary Lake Basins.](#)
- [IOC-UNESCO \(2011\). Methodology for the GEF Transboundary Waters Assessment Programme. Volume 5. Methodology for the Assessment of Large Marine Ecosystems.](#)
- [IOC-UNESCO \(2011\). Methodology for the GEF Transboundary Waters Assessment Programme. Volume 6. Methodology for the Assessment of the Open Ocean.](#)
- [UNEP \(2011\). Jeftic et al. \(Eds.\). Methodology for the GEF Transboundary Waters Assessment Programme. Volume 1. Methodology for the Assessment of Transboundary Aquifers, Lake Basins, River Basins, Large Marine Ecosystems, and the Open Ocean.](#)
- [UNEP-DHI \(2011\). Methodology for the GEF Transboundary Waters Assessment Programme. Volume 4. Methodology for the Assessment of Transboundary River Basins.](#)
- [UNESCO-IHP \(2011\). Methodology for the GEF Transboundary Waters Assessment Programme. Volume 2. Methodology for the Assessment of Transboundary Aquifers.](#)
- [Costello et al. \(2010\). A Census of Marine Biodiversity Knowledge, Resources, and Future Challenges.](#)
- [First Census of Marine Life 2010 \(2010\): Highlights of a Decade of Discovery.](#)
- [UNEP \(2010\). Global Synthesis: A report from the Regional Seas Convention and Action Plans for the Marine biodiversity assessment and outlook series.](#)
- [Helsinki Commission \(2009\). Biodiversity in the Baltic Sea. An integrated thematic assessment on biodiversity and nature conservation in the Baltic Sea.](#)

- [Lester et al. \(2009\). Biological effects within no-take marine reserves: a global synthesis.](#)
- [Obura, D.O. and Grimsdith, G. \(2009\). Resilience Assessment of coral reefs – Assessment protocol for coral reefs, focusing on coral bleaching and thermal stress.](#)
- [Palumbi et al. \(2009\). Managing for ocean biodiversity to sustain marine ecosystem services.](#)
- [UNEP, IOC-UNESCO \(2009\). An Assessment of Assessments. Findings of the Group of Experts.](#)
- [Waycott et al. \(2009\). Accelerating loss of seagrasses across the globe threatens coastal ecosystems.](#)
- [Crowder and Norse \(2008\). Essential ecological insights for marine ecosystem-based management and marine spatial planning.](#)
- [Garcia, S.M. \(2008\). Fisheries Assessment and Decision Making: Towards an Integrated Advisory Process.](#)
- [Halpern et al. \(2008\). A global map of human impact on marine ecosystems.](#)
- [Boero F. and Bonsdorff E. \(2007\). A conceptual framework for marine biodiversity and ecosystem functioning.](#)
- [Byrnes \(2007\). Invasions and Extinctions Reshape Coastal Marine Food Webs.](#)
- [Heithaus et al. \(2007\). Predicting ecological consequences of marine top predator declines. Trends in Ecology and Evolution.](#)
- [Hilborn \(2007\). Defining success in fisheries and conflicts in objectives.](#)
- [Leslie H. and McLeod K. \(2007\). Confronting the challenges of implementing marine ecosystem-based management.](#)
- [Murawski et al. \(2007\). Biodiversity Loss in the Ocean: How Bad Is It?](#)
- [SEAFDEC \(2007\). Fish for the People. A special publication for the promotion of sustainable fisheries for food security in the ASEAN region, Volume 5.](#)
- [SEAFDEC \(2006\). Regional guidelines for responsible fisheries in Southeast Asia: Supplementary Guidelines on Co-management using Group User Rights, Fishery Statistics, Indicators and Fisheries Refugia.](#)
- [Secretariat of the Convention on Biological Diversity \(2006\). Guidelines for the rapid ecological assessment of biodiversity in inland water, coastal and marine areas.](#)
- [Worm et al. \(2006\). Impacts of Biodiversity Loss on Ocean Ecosystem Services.](#)

	<ul style="list-style-type: none"> • Aydin et al. (2005). Linking oceanic food webs to coastal production and growth rates of Pacific salmon (<i>Oncorhynchus</i> spp.), using models on three scales. • Bascompte et al. (2005). Interaction strength combinations and the overfishing of a marine food web. • Pauly, D. and M.L. Palomares (2005). Fishing down marine food webs: it is far more pervasive than we thought. • Mumby, P., et al. (2004). Mangroves enhance the biomass of coral reef fish communities in the Caribbean. Nature 427, 533-536. • Bremner et al. (2003). Assessing Marine Ecosystem Health: The Long-Term Effects of Fishing on Functional Biodiversity in North Sea Benthos. • Kondoh, M. (2003). Foraging Adaptation and the Relationship between Food-Web Complexity and Stability. • Loreau et al. (2002). Biodiversity and ecosystem functioning: synthesis and perspectives. • Loreau et al. (2001). Biodiversity and ecosystem functioning: current knowledge and future challenges. • Rapport et al. (1998). Assessing ecosystem health. • Pauly, D. and Christensen, V. (1995). Primary production required to sustain global fisheries. • Pauly, D. (1995). Anecdotes and the shifting baseline syndrome of fisheries. 	
Oceans, Seas and marine resources (<i>Ecosystem Integrity</i>) → HUMAN WELL-BEING		
Inter-linkages	Illustrative scientific reports*	Further research areas suggested by contributing experts:
<p>Creation of livelihoods and jobs</p> <p>[e.g. in fisheries and aquaculture, maritime transportation, shipbuilding, ports and related services, coastal developments, tourism, oil, gas, mining industries and emerging sectors (e.g., offshore renewable energy¹)]</p>	<ul style="list-style-type: none"> • UN World Ocean Assessment (2015) • Mapping Ocean Wealth <p>-----</p> <ul style="list-style-type: none"> • APEC Ocean and Fisheries Working Group (2014). APEC Marine Sustainable Development Report. • FAO (2014). The State of World Fisheries and Aquaculture - Opportunities and Challenges. • FAO (2014). Voluntary Guidelines for Securing Sustainable Small-scale Fisheries. • Glaser, M. and Glaeser, B. (2014). Towards a framework for cross-scale and multi-level analysis of coastal and marine social-ecological systems dynamics. • UNCTAD (2014). Review of Maritime Transport. • UNDESA, UN-DOALOS/OLA, IAEA, IMO, IOC-UNESCO, UNDP, UNEP, UNWTO (2014): How oceans- and seas-related measures contribute to the economic, social and environmental 	<ul style="list-style-type: none"> • Census of small-scale fisheries; better document impact of small-scale fisheries and small and medium-scale aquaculture enterprises; improve availability and quality of disaggregated data • Census of people depending on coastal resources for consumption/sale • Mapping and qualitative and quantitative evaluation of ecosystem services • Quantification of distribution of wealth generated by newer industries (e.g. eco-tourism) among communities, gender etc. • Role of women in fisheries • Impact of increasingly connected markets and consumption on local livelihoods, food security and resource management • Economic consequences of ecosystem responses to changing biodiversity • Economic and environmental viability of regional wave and other renewable energy devices • Green economy approach in ocean sectors; Contribution of blue natural capital to macroeconomics

	<p>dimensions of sustainable development: Local and regional experiences.</p> <ul style="list-style-type: none"> • UNDESA (2014). Partnerships Briefs for Small Island Developing States: Oceans, Seas and Biodiversity. • World Tourism Organization (2014). Towards measuring the economic value of wildlife watching tourism in Africa. • Begossi (2013). Small-scale Fisheries and Biodiversity: Alleviating Poverty and Conserving Natural Resources. • Ferrol-Schulte et al. (2013). Sustainable Livelihoods Approach in tropical coastal and marine social–ecological systems: A review. • Global Partnership for Oceans (2013). Indispensable ocean. Aligning ocean health and human well-being. Guidance from the Blue Ribbon Panel to the Global Partnership for Oceans. • Nunes P. and Ghermandi A. (2013). The Economics of Marine Ecosystems: Reconciling Use and Conservation of Coastal and Marine Systems and the Underlying Natural Capital. • Ruckelshaus et al. (2013). Securing ocean benefits for society in the face of climate change. • Technical support team for United Nations General Assembly Open Working Group on Sustainable Goals (2013). Issues Brief: Oceans and Seas. • Teh, L.C.L. and Sumaila, U.R. (2013). Contribution of marine fisheries to worldwide employment. • Ahamed et al (2012). Indiscriminate exploitation of wild prawn postlarvae in the coastal region of Bangladesh: A threat to the fisheries resources, community livelihoods and biodiversity. • Glaser et al. (2012). Measuring and understanding sustainability-enhancing processes in tropical coastal and marine social–ecological systems. • IMO (2012). International Shipping Facts and Figures-Information Resources on Trade, Safety, Security, Environment. • Secretariat of the Ramsar Convention on Wetlands and UNWTO (2012). Destination wetlands: supporting sustainable tourism. • UNCTAD (2012): Review of maritime transport. • UNEP et al. (2012). Green Economy in a Blue World. • UNEP and UNWTO (2012). Tourism in the Green Economy – Background Report. • UNWTO (2012). Challenges and Opportunities for Tourism Development in Small Island Developing States. • Zivin J.G. and Damon M. (2012). Environmental policy and political realities: fisheries 	<ul style="list-style-type: none"> • Distribution of power among participants in marine sectors/industries and ways to address inequities where they occur • Measurement of socio-economic value of marine and coastal tourism • Adaptive capacity of communities and livelihoods vis-a-vis threats • Undertake risk assessments and identify hazardous activities in specific fish value chains that pose risks to young people /support child labour
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	<p>management and job creation in the Pacific islands.</p> <ul style="list-style-type: none"> • Allison E.H. (2011). Aquaculture, fisheries, poverty and food security. • Allison et al. (2011). Human Rights Approaches to Governing Fisheries. • Datta et al. (2011). Prospective livelihood opportunities from the mangroves of the Sunderbans, India. • Daw et al. (2011). Applying the ecosystem services concept to poverty alleviation: the need to disaggregate human well-being. • IOC/UNESCO, IMO, FAO, UNDP. (2011). A Blueprint for Ocean and Coastal Sustainability. • World Fish Center (2011). Aquaculture, Fisheries, Poverty and Food Security. • Béné et al. (2010). Not by rent alone: analyzing the pro-poor functions of small-scale fisheries in developing countries. • Dyck and Sumaila (2010). Economic impact of ocean fish populations in the global fishery. • Secretariat of the Convention on Biological Diversity (2010). Linking Biodiversity Conservation and Poverty Alleviation: A State of Knowledge Review. • Carter et al. (2009). Submarine Cables and the Oceans: Connecting the World. • Palumbi et al. (2009). Managing for ocean biodiversity to sustain marine ecosystem services. • Secretariat of CBD (2009). Biodiversity, Development and Poverty Alleviation. Recognizing the role of Biodiversity for Human Well-being. • The World Bank and FAO (2009). The Sunken Billions: The Economic Justification for Fisheries Reform. • Garcia, S.M. et al (2008). Towards integrated assessment and advice in small-scale fisheries: principles and processes. • Iftekhar, M.S. and Takama, T. (2008). Perceptions of biodiversity, environmental services, and conservation of planted mangroves: a case study on Nijhum Dwip Island, Bangladesh. • Leslie H. and McLeod K. (2007). Confronting the challenges of implementing marine ecosystem-based management. • Béné et al. (2006). Increasing the contribution of small-scale fisheries to poverty alleviation and food security. • UNEP-WCMC (2006). In the front line: shoreline protection and other ecosystem services from mangroves and coral reefs. • FAO (2006). Trends in poverty and livelihoods in coastal fishing communities of Orissa State, India. 	
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	<ul style="list-style-type: none"> • Silva P. (2006). Exploring the Linkages between Poverty, Marine Protected Area, Management, and the Use of Destructive Fishing Gear in Tanzania. • Allison, E.H. (2005). The fisheries sector, livelihoods and poverty reduction in eastern and southern Africa. • FAO (2005). Increasing the contribution of small-scale fisheries to poverty alleviation and food security. • Garcia, S.M. and Grainger, R. (2005). Gloom and doom? The future of marine capture fisheries. • World Resources Institute (WRI) in collaboration with United Nations Development Programme, United Nations Environment Programme, and World Bank (2005). World Resources 2005: The Wealth of the Poor—Managing Ecosystems to Fight Poverty. • Horemans B. (2004). The work of the sustainable fisheries livelihoods programme (SFLP) in West Africa. • Neiland AE. (2004). Fisheries development, poverty alleviation and small scale-fisheries: a review of policy and performance in developing countries since 1950. • Pittaluga et al. (2004). Poverty profiles of artisanal fishers: methods based on the SLA model. • Béné C. (2003). When fishery rhymes with poverty: a first step beyond the old paradigm on poverty in small-scale fisheries. • Charles (2001). Sustainable fishery systems. 	
<p>Provisioning services (food, fresh water, raw materials, pharmaceutical compounds)</p> <p>Regulating services (climate regulation, emission absorption and storage, shoreline protection)</p> <p>Cultural services (recreation, spiritual and religious sites, aesthetics)</p>	<ul style="list-style-type: none"> • UN World Ocean Assessment (2015) • Ocean Health Index ----- • Shen et al. (2015) Willingness to pay for ecosystem services of open oceans by choice-based conjoint analysis: A case study of Japanese residents. • Beaumont et al. (2014). The value of carbon sequestration and storage in coastal habitats. • Costanza et al. (2014). Changes in the global value of ecosystem services. • FAO (2014). The State of World Fisheries and Aquaculture - Opportunities and Challenges. • Galparsoro et al. (2014). Mapping ecosystem services provided by benthic habitats in the European North Atlantic Ocean. • High-level Panel of Experts on Food Security and Nutrition (2014). 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, Rome 2014. 	<ul style="list-style-type: none"> • Map and inventory of ecosystem services; role for human well-being - links and interdependencies • More comprehensive valuation of regulatory services provided by coastal habitats • Systematic qualitative and quantitative evaluation of ecosystem services, including aboriginal usage, views and values • Better quantification of the role of seafood in food security • Connection between high seas and ecosystem services in coastal areas • Extended research into cultural ecosystem services • Impact of global threats on provision of ecosystem services

	<ul style="list-style-type: none"> • International Fund for Agricultural Development (IFAD) (2014). IFAD’s approach in Small Island Developing States. A global response to island voices for food security. • IUCN (2014). The Significance and Management of Natural Carbon Stores in the Open Ocean – A Summary. • Laffoley et al. (2014). The Significance and Management of Natural Carbon Stores in the Open Ocean. • Lutz SJ, Martin AH (2014). Fish Carbon: Exploring Marine Vertebrate Carbon Services. • Spalding et al. (2014) The role of ecosystems in coastal protection: Adapting to climate change and coastal hazards. • Sumaila et al. (2014). Winners and losers in a world where the high seas is closed to fishing. Nature. Scientific Report 5, Article number: 8481. • UNCTAD (2014). The Oceans Economy: Opportunities and Challenges for Small Island Developing States. • UNEP (2014). The Importance of Mangroves to People: A Call to Action. • UNEP (2014). Guidance Manual on Valuation and Accounting of Ecosystem Services for Small Island Developing States. • Visbeck et al. (2014 a). Securing blue wealth: The need for a special sustainable development goal for the ocean and coasts. • Wakita et al. (2014). Human utility of marine ecosystem services and behavioural intentions for marine conservation in Japan. • World Resources Institute (2014). Coastal Capital: Economic valuation of coastal ecosystem in the Caribbean. • WWF (2014). Living Planet Report 2014: Species and spaces, people and places. • Arkema et al. (2013). Coastal habitats shield people and property from sea-level rise and storms. • Burge et al. (2013). Special Issue Oceans and Humans Health: The Ecology of Marine Opportunists. • Butler et al. (2013). An analysis of trade-offs between multiple ecosystem services and stakeholders linked to land use and water quality management in the Great Barrier Reef, Australia. • Guerry et al. (2013). Modeling Marine Ecosystem Services. • Noone K. et al. (2013). Managing Ocean Environments in a Changing Climate: 	
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	<p>Sustainability and Economic Perspectives.</p> <ul style="list-style-type: none"> • Technical support team for United Nations General Assembly Open Working Group on Sustainable Goals (2013). Issues Brief: Biodiversity. • Technical support team for United Nations General Assembly Open Working Group on Sustainable Goals (2013). Issues Brief: Oceans and Seas. • Vierros (2013). Communities and blue carbon: the role of traditional management systems in providing benefits for carbon storage, biodiversity conservation and livelihoods. • Winnie W.Y. Lau (2013). Beyond carbon: Conceptualizing payments for ecosystem services in blue forests on carbon and other marine and coastal ecosystem services. • Armstrong et al. (2012). Services from the deep: steps towards valuation of deep sea goods and services. • Burke et al. (2012). Reefs at Risk Revisited in the Coral Triangle. World Resources Institute. • Newton et al. (2012). The coastal syndromes and hotspots on the coast. • UNEP (2012). Avoiding Future Famines: Strengthening the Ecological Foundation of Food Security through Sustainable Food Systems. • Barbier et al. (2011). The value of estuarine and coastal ecosystem services. • Béné et al. (2011). The Forgotten Service: Food as an Ecosystem Service from Estuarine and Coastal Zones. • Burke et al. (2011). Reefs at risk revisited. World Resources Institute. • Busch et al. (2011). Conceptualizing the link between marine ecosystem services and human well-being: the case of offshore wind farming. • FAO (2011). Global aquaculture production statistics. • Rice J.C. and Garcia, S.M. (2011). Fisheries, food security, climate change, and biodiversity: characteristics of the sector and perspectives on emerging issues. • UNEP (2011). L. Jeftic et al. (Eds.). Methodology for the GEF Transboundary Waters Assessment Programme. Volume 1. Methodology for the Assessment of Transboundary Aquifers, Lake Basins, River Basins, Large Marine Ecosystems, and the Open Ocean. • Chan, K. M. and Ruckelshaus, M. (2010). Characterizing changes in marine ecosystem 	
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[services.](#)

- [Garcia, S. M., and Rosenberg, A. \(2010\). Food security and marine capture fisheries: characteristics, trends, drivers and future perspectives.](#)
- [Mascia et al. \(2010\). Impacts of Marine Protected Areas on Fishing Communities.](#)
- [Diversitas \(2009\). What Are Coral Reef Services Worth?](#)
- [Trumper et al. \(2009\). The Natural Fix? The role of ecosystems in climate mitigation. A UNEP rapid response assessment. United Nations Environment Programme.](#)
- [UNEP, IOC-UNESCO \(2009\). An Assessment of Assessments. Findings of the Group of Experts.](#)
- [Waycott et al. \(2009\). Accelerating loss of seagrasses across the globe threatens coastal ecosystems.](#)
- [Costanza et al. \(2008\). The value of coastal wetlands for hurricane protection.](#)
- [Duffy, J. \(2008\). Marine biodiversity and food security.](#)
- [Glavovic, B. \(2008\). Ocean and Coastal Governance for Sustainability: Imperatives for Integrating Ecology and Economics.](#)
- [Patterson, M. and Glavovic, B. \(2008\). Ecological economics of the oceans and coasts Edward Elgar Publishing.](#)
- [Riser and Johnson \(2008.\) Net production of oxygen in the subtropical ocean.](#)
- [World Fish Center \(2008\). Ecosystem Services for Poverty Alleviation: Marine & Coastal Situational Analysis.](#)
- [Beaumont et al. \(2007\). Identification, definition and quantification of goods and services provided by marine biodiversity: implications for the ecosystem approach.](#)
- [CARSEA \(2007\). Caribbean Sea Ecosystem Assessment \(CARSEA\). A sub-global component of the Millennium Ecosystem Assessment \(MA\).](#)
- [Stachowicz et al. \(2007\). Understanding the effects of marine biodiversity on community and ecosystem processes.](#)
- [Sala, E. and Knowlton, N. \(2006\). Global marine biodiversity trends.](#)
- [UNEP \(2006\). Marine and Coastal Ecosystems and Human Well-Being. A Synthesis Report based on the findings of the Millennium Ecosystem Assessment.](#)
- [Worm et al. \(2006\). Impacts of Biodiversity Loss on Ocean Ecosystem Services.](#)

	<ul style="list-style-type: none"> • FAO (2005). Increasing the contribution of small-scale fisheries to poverty alleviation and food security. • Millennium Ecosystem Assessment (2005). Chapter 18 - Marine Systems. • Millennium Ecosystem Assessment (2005). Chapter 19 – Coastal systems. • Millennium Ecosystem Assessment (2005). Chapter 23 – Island systems. • Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Synthesis. • Pauly et al. (2005). Global trends in world fisheries: impacts on marine ecosystems and food security. • Srivastava, D.S. and Vellend, M. (2005). Biodiversity-ecosystem function research: is it relevant to conservation? • WHO (2005). Ecosystems and human well-being: Health synthesis. • Eagles et al. (2002). Sustainable Tourism in Protected Areas: Guidelines for Planning and Management. • C.M. Duarte (2000). Marine biodiversity and ecosystem services: an elusive link. • Costanza, R. (1999). The ecological, economic, and social importance of the oceans. • Costanza et al. (1999a). Ecological economics and sustainable governance of the oceans. 	
<p>Potential access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed²</p>	<ul style="list-style-type: none"> • ABS Capacity Development Initiative (2014). Relevance of marine bioprospecting for access and benefit sharing frameworks. • Arnaud-Haond et al. (2011). Marine biodiversity and gene patents. • Leary et al. (2009). Marine genetic resources: A review of scientific and commercial interest. • Oli et al. (2008). Access and benefit sharing from genetic resources. • Oli et al. (2007). Glossary of access and benefit sharing terms. • German Advisory Group on Global Change (WBGU) (2004). World in Transition. Fighting Poverty through Environmental Policy. • IUCN (2004a). Access to genetic resources and benefit sharing: Key questions for decision makers. • IUCN (2004b). Accessing biodiversity and sharing the benefits: Lessons from implementing the Convention on Biological Diversity. • Gudrun et al. (2003). Access and benefit-sharing (ABS): An instrument for poverty alleviation, Proposals for an International ABS 	<ul style="list-style-type: none"> • Evaluation of marine genetic resources with focus on commercially viable species (e.g. algae and extremophiles) • Role and impacts of bioprospecting, especially in areas beyond national jurisdiction • Development of low-tech methods for screening for product potential from marine genetic resources • Develop methodologies for traceability of products from marine genetic resources • Examine access and benefit-sharing systems for their consistency, effectiveness and feasibility

	<p>Regime.</p> <ul style="list-style-type: none"> • Wynberg, R. (2003). A review of benefit sharing arrangements for biodiversity prospecting in South Africa. Secretariat of CBD and UNEP (2002). Bonn guidelines on access to genetic resources and fair and equitable sharing of the benefits arising out of their utilization. • World Bank (2001). World development report 2000/2001: Attacking poverty. 	
HUMAN WELL-BEING → Oceans, Seas and marine resources (Ecosystem Integrity)		
Inter-linkages	Illustrative assessments*	Further research areas suggested by contributing experts:
<p>Within an enabling environment (Box 3), reduced negative impacts on marine and coastal ecosystems due to more sustainable use of marine and coastal resources and improved management of human activities</p>	<ul style="list-style-type: none"> • UN World Ocean Assessment (2015)³ • Blasiak et al. (2014). Paradigms of sustainable ocean management. • Newton, A. and Weichselgartner, J. (2014). Hotspots of coastal vulnerability: A DPSIR analysis to find societal pathways and responses. • UNCTAD (2014). The fisheries sector in the Gambia: trade, value addition and social inclusiveness, with a focus on women. • UNCTAD (2014). The Oceans Economy: Opportunities and Challenges for Small Island Developing States. • Brewer et al. (2013). Effects of Human Population Density and Proximity to Markets on Coral Reef Fishes Vulnerable to Extinction by Fishing. • Glavovic, B. C. (2013a). Coastal Innovation Imperative. • Glavovic, B. C. (2013b). Coastal Innovation Paradox. • Schlüter et al. (2013). Institutional Change, Sustainability and the Sea. • Burke et al. (2012). Reefs at Risk Revisited in the Coral Triangle. World Resources Institute. • Guerry et al. (2012). Modeling benefits from nature: using ecosystem services to inform coastal and marine spatial planning. • Burke et al. (2011). Reefs at risk revisited. World Resources Institute. • Glavovic, B. C. (2011). Coastal innovation paradox and imperative: Reframing coastal governance. • Gutierrez et al. (2011). Leadership, social capital and incentives promote successful fisheries. • Foley et al. (2010). Guiding ecological principles for marine spatial planning. • Forest Trends (2010). Payments for Ecosystem Services: Getting Started in Marine and Coastal Ecosystems. A Primer. • Mascia et al. (2010). Impacts of Marine Protected Areas on Fishing Communities. • Patterson, L.M. (2010). A Review of “Policies for Sustainable Governance of Global 	<ul style="list-style-type: none"> • Effects of changes in lifestyle (e.g., production, consumption, social organization) on sustainability of marine resource use • Incentives for changing behaviour such as payment for ecosystem services and participatory management schemes • Data availability and resolution at different levels and geographic spread • Synthesis of lessons from (successful) projects • Cost – benefit analysis of effects of coastal tourism • Impacts of human sectoral activities on marine and coastal resources and ecosystem integrity • Effects of improved management of human activities on marine and coastal resources • Reaction of communities to imposition of management measures on their livelihoods, and ways to increase compliance and cooperation between regulators and those being regulated • Comparison of ports to ascertain their performances in terms of corporate social responsibility and sustainability goals

	<p>Ecosystem Services".</p> <ul style="list-style-type: none"> • Pitcher, T. J., and M. E. Lam. (2010). Fishful thinking: rhetoric, reality, and the sea before us. • Secretariat of CBD (2010). Linking biodiversity conservation and poverty alleviation: A State of Knowledge Review. • Tallis et al. (2010). The many faces of ecosystem-based management: Making the process work today in real places. • UNEP (2010). Global Synthesis: A report from the Regional Seas Convention and Action Plans for the Marine biodiversity assessment and outlook series. • Cinner et al. (2009). Linking Social and Ecological Systems to Sustain Coral Reef Fisheries. • Levin et al. (2009). Integrated ecosystem assessments: developing the scientific basis for ecosystem-based management of the ocean. • Glavovic, B. (2008). Ocean and Coastal Governance for Sustainability: Imperatives for Integrating Ecology and Economics. • Glavovic, B. (2008a). Ocean and Coastal Governance for Sustainability: Imperatives for Integrating Ecology and Economics. • Ruckelshaus et al. (2008). Marine ecosystem-based management in practice: scientific and governance challenges. Bioscience 58 53-63. • Cinner, Joshua E., and Shankar Aswani (2007). Integrating customary management into marine conservation. • Duxbury, J. and Dickinson, S. (2007). Principles for sustainable governance of the coastal zone: In the context of coastal disasters. • Langmead et al. (2007). European Lifestyles and Marine Ecosystems: Exploring challenges for managing Europe's seas. • Marschke, M. and Sinclair, A.J. (2007). Learning for sustainability: Participatory resource management in Cambodian fishing villages. • McClanahan et al. (2006). A comparison of marine protected areas and alternative approaches to coral-reef management. • FAO (2005). Reducing fisherfolk's vulnerability leads to responsible fisheries. • Srivastava, D.S. and Vellend, M. (2005). Biodiversity-ecosystem function research: is it relevant to conservation? • Eagles et al. (2002). Sustainable Tourism in Protected Areas: Guidelines for Planning and Management. • C.M. Duarte (2000). Marine biodiversity and ecosystem services: an elusive link. • FAO (1995). The code of conduct for responsible fisheries. 	
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¹ e.g., wind and solar energy, hydropower, geothermal energy, and bio-energy

² This point is added with the clear understanding that negotiations are still ongoing at the global policy level. The last meeting of the Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction, held in January 2015, stressed the need for a comprehensive global regime to better address the conservation and sustainable use of marine biodiversity beyond areas of national jurisdiction and resulted in the recommendation to develop an international legally-binding instrument under the United Nations Convention on the Law of the Sea (See also: A/69/780). Work is also undertaken to promote the entry into force and implementation of international instruments addressing a number of issues related, generally, to genetic resources (e.g. Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity). In addition, discussions are ongoing with regard to the development of an international instrument addressing the intellectual property rights aspects of genetic resources. (See also: Secretary-General report A/69/71/Add.1).

³ <http://www.worldoceanassessment.org/>