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**SUBSIDIARY BODY ON SCIENTIFIC,  
TECHNICAL AND TECHNOLOGICAL ADVICE**

Sixteenth meeting  
Montreal, 30 April - 5 May 2012  
Item 6.2 of the provisional agenda\*

**ADDRESSING ADVERSE IMPACTS OF HUMAN ACTIVITIES ON MARINE AND COASTAL  
BIODIVERSITY, INCLUDING CORAL BLEACHING, OCEAN ACIDIFICATION, FISHERIES  
AND UNDERWATER NOISE**

*Note by the Executive Secretary*

**EXECUTIVE SUMMARY**

In response to requests of the Conference of the Parties at its tenth meeting, the Executive Secretary has carried out a number of activities addressing the adverse impacts of human activities on marine and coastal biodiversity, including:

- (a) Preparation of a report on progress made in the implementation of specific workplan on coral bleaching;
- (b) Preparation of a study on the impacts of anthropogenic underwater noise;
- (c) Organization of a joint expert meeting on addressing biodiversity concerns in sustainable fishery; and
- (d) Organization of joint expert review process on the impacts of ocean acidification.

These activities are relevant to the implementation of the Strategic Plan for Biodiversity and the achievement of the Aichi Biodiversity Targets, in particular targets 6, 8 and 10.

Despite considerable progress made in the implementation of specific work plan on coral bleaching in terms of enhancing reef resilience, coral bleaching response planning, and the availability of scientific information on coral ecosystems, there is an urgent need to update the current specific work plan to address compounding effects of multiple stressors such as ocean acidification, sea level rise and increasing natural tropical storms, and other local stressors.

Anthropogenic underwater noise is an increasing problem that affects many marine mammals and other biota that needs to be addressed through more research, greater awareness of the issue and through the application of mitigation measures.

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\* UNEP/CBD/SBSTTA/16/1.

Addressing biodiversity concerns in sustainable fisheries requires enhanced collaboration among different sectors and agencies involved in these issues; applying integrated management frameworks based on the ecosystem approach; and increasing the participation of biodiversity experts in the relevant assessment and management processes.

Ocean acidification needs to be addressed through measures to reduce various threats to vulnerable ecosystems as part of existing integrated marine and coastal management programmes, marine protected areas, and ecologically or biologically significant marine areas, in addition to measures to reduce carbon dioxide emissions.

Marine debris is an increasing threat to marine and coastal biodiversity. Entanglement or ingestion by birds, turtles, fish and marine mammals is well documented and can be fatal. Small particles are also of concern.

### **SUGGESTED RECOMMENDATIONS**

The Subsidiary Body on Scientific, Technical and Technological Advice may wish to recommend that the Conference of the Parties at its eleventh meeting adopts a decision along the following lines:

*The Conference of the Parties*

#### ***Progress made in the implementation of the specific work plan on coral bleaching***

1. *Welcomes* the report on the progress made in the implementation of the specific work plan on coral bleaching (UNEP/CBD/SBSTTA/16/INF/11), adopted in decision VII/5 (appendix 1 to annex I), and the barriers to implementation as well as ways to overcome them, including specific actions to mobilize financial resources, and *takes note*, of the key messages of the report provided in annex I to the present note;

2. *Notes* that substantial progress has been made since the specific work plan was adopted;

3. *Expresses its concerns* that many recurrent capacity and financial challenges remain, which preclude significant progress in some regions, and that many countries are still struggling to cope with localized stressors and do not have the capacity or financial resources to fully incorporate climate-change effects into coral reef or coastal management programmes;

4. *Takes note* of the urgent need to update the specific workplan on coral bleaching taking into consideration other global impacts on coral reefs caused by climate change, most notably, ocean acidification, but also the effects of tropical storms and rising sea levels, recognizing that the current and projected impacts of ocean acidification need to be integrated into management frameworks alongside the interaction with local stressors as our understanding of multiple stressors improves;

5. *Further notes* that meeting the growing challenge of climate-change impacts on coral reefs will require significant investment to increase the capacity for effective management of future bleaching events and other stressors and to scale up the delivery of resilience assessments in all coral-reef regions, and that identifying a range of viable finance mechanisms to achieve these goals is critical;

6. *Recognizing* the need for managers of coral reef ecosystems:

(a) To understand the vulnerability of reef systems to multiple stressors;

(b) To plan proactively for climate risks and associated secondary effects, applying ecosystem-based adaptation;

(c) To manage coral reefs as socio-ecological systems undergoing change, predominantly caused by climate modification;

(d) To formulate adaptation strategies that aim to enhance the resilience of ecosystems to enable the continued provision of goods and services;

7. *Requests* the Executive Secretary to collaborate with Parties, other Governments and relevant organizations, to develop proposals to update the specific work plan on coral bleaching through an addendum to the work plan that addresses the needs set out in paragraph 6 above, and to submit this set of elements for consideration at a future meeting of the Subsidiary Body prior to the twelfth meeting of the Conference of the Parties;

#### ***Impacts of anthropogenic underwater noise on marine and coastal biodiversity***

8. *Welcomes* the report on the impacts of anthropogenic underwater noise on marine and coastal biodiversity (UNEP/CBD/SBSTTA/16/INF/12), and *takes note*, of the key messages of the report provided in annex II to the present note;

9. *Takes note* of resolution 10.24 adopted by the Conference of the Parties to the Convention on Migratory Species at its tenth meeting, which provides guidance on further steps to abate underwater noise pollution for the protection of cetaceans and other migratory species;

10. *Notes* that anthropogenic sound can have both short and long-term negative consequences for marine animals and other biota in the marine environment, that this issue is likely to increase in significance over the next few decades, and that an uncontrolled increase in anthropogenic noise would be likely to add significant further stress to already-stressed oceanic biota;

11. *Urges* Parties, other Governments and organizations to:

- (a) Promote research with a view to improving our understanding of the issue;
- (b) Promote awareness of the issue by relevant stakeholders both nationally and regionally;
- (c) Take measures to minimize the impacts of anthropogenic underwater noise on marine biodiversity, including, as appropriate, the use of spatio-temporal restrictions, drawing upon existing guidance that has been developed by national and regional bodies;

12. *Noting* the gaps and limitations in existing guidance, including the need to update it in the light of improving scientific knowledge, *requests* Executive Secretary to collaborate with Parties, other Governments and relevant organizations, including Secretariat of the Convention on Migratory Species, the International Maritime Organization, the International Whaling Commission, and other competent organizations, to organize an expert workshop with a view to developing practical guidance and toolkits for minimizing and mitigating the impacts of anthropogenic underwater noise on marine and coastal biodiversity, which can assist Parties and other Governments in applying necessary management and regulatory measures at national and regional levels and incorporating them into their existing integrated marine and coastal management programmes, establishment and management of marine protected areas, and management of ecologically or biologically significant marine areas;

13. *Further requests* the Executive Secretary to bring this decision to the attention of the organizations referred to in paragraph 12 above;

#### ***Addressing biodiversity concerns in sustainable fishery***

14. *Expresses its gratitude* to the Government of Norway for funding and hosting a joint expert meeting on addressing biodiversity concerns in sustainable fisheries, convened by Executive Secretary in collaboration with the United Nations Environment Programme (UNEP), the Food and Agriculture Organization of the United Nations (FAO) and the Fisheries Expert Group of the IUCN Commission of Ecosystem Management (IUCN-CEM-FEG), in Bergen, Norway, from 7 to 9 December

2011, and *welcomes* the meeting report of the joint expert meeting on addressing biodiversity concerns in sustainable fisheries (UNEP/CBD/SBSTTA/16/INF/13);

15. *Recognizing* that fisheries management bodies at all levels are the competent bodies for managing fisheries, including the impacts of fisheries on biodiversity, *takes note* of a need for enhanced capacity of these fisheries management agencies, constructive interagency collaboration, and full and meaningful participation of a wide range of biodiversity experts and relevant stakeholders in the fisheries management process;

16. *Invites* fisheries management bodies at national and regional levels in collaboration with the Food and Agriculture Organization of the United Nations (FAO) to enhance their mandates of the governance and assessment components so that biodiversity considerations are explicitly a core part of their work and accountability;

17. *Requests* the Executive Secretary to transmit the report of the joint expert meeting to the relevant fisheries management bodies at national and regional levels, and to collaborate with these bodies with a view to improving how biodiversity concerns are addressed in sustainable fisheries;

***Progress made in joint expert review process to monitor and assess the impacts of ocean acidification on marine and coastal biodiversity***

*Recalling* paragraphs 63–67 of decision X/29,

18. *Expresses its gratitude* to the Government of Spain for funding a meeting on joint expert review process on the impacts of ocean acidification, convened by Executive Secretary in collaboration with the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (IOC/UNESCO), in Montreal, on 19-20 October 2011, and *welcomes* report of the expert meeting (UNEP/CBD/SBSTTA/16/INF/14);

19. *Requests* Executive Secretary to collaborate with IOC/UNESCO and relevant scientific groups on the preparation of a systematic review document of ocean acidification impacts on biodiversity and ecosystem functions, which will provide a targeted synthesis of the biodiversity implications of ocean acidification for marine and coastal systems, including information on the less-reported paleo-oceanographic research, building upon the synthesis provided in CBD Technical Series No. 46, and make it available to Parties, other Governments and relevant organizations and transmit it to the Secretariat of United Nations Framework Convention on Climate Change (UNFCCC);

20. *Takes note* of the elements in annex III to the present note as guidance for practical responses to ocean acidification impacts on marine and coastal biodiversity, and *encourages* Parties, other Governments and relevant organizations to make use of this guidance, as appropriate, through their existing integrated marine and coastal management programmes, marine protected areas, and ecologically or biologically significant marine areas;

***Addressing impacts of marine debris on marine and coastal biodiversity***

21. *Welcomes* the preparation by the GEF-STAP of a report on the impacts of marine debris on marine and coastal biodiversity (UNEP/CBD/SBSTTA/16/INF/15), and *takes note* of the key messages contained in annex IV of the present note;

22. *Requests* Executive Secretary in collaboration with Parties, other Governments and relevant organizations;

(a) To organize an expert workshop to prepare practical guidance on preventing and mitigating the adverse impacts of marine debris on marine and coastal biodiversity and habitats, which

can be applied by Parties and other Governments in their implementation of the programme of work on marine and coastal biodiversity;

(b) To compile and synthesize further scientific information on the impacts of marine debris on marine and coastal biodiversity and habitats in preparation for the expert workshop;

(c) To submit the compilation/synthesis and the practical guidance for consideration to a meeting of the Subsidiary Body prior to the twelfth meeting of the Conference of the Parties.

## I. INTRODUCTION

1. In its decision X/29, the Conference of the Parties requested the Executive Secretary to undertake a number of activities with a view to addressing adverse impacts of human activities, including coral bleaching, ocean acidification, fisheries and underwater noise, on marine and coastal biodiversity.

2. These activities support the achievement of targets 6, 8 and 10 of the Strategic Plan:

(a) *Target 6:* By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits;

(b) *Target 8:* By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity;

(c) *Target 10:* By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

## II. PROGRESS MADE IN THE IMPLEMENTATION OF THE SPECIFIC WORKPLAN ON CORAL BLEACHING

3. Pursuant to paragraph 74 of decision X/29, the Executive Secretary prepared a report, as contained in the document UNEP/CBD/SBSTTA/INF/11, on the progress made in the implementation of the specific work plan on coral bleaching, adopted in decision VII/5 (appendix I of annex I), which identified barriers to implementation and ways to overcome them as well as specific actions to mobilize financial resources. The key messages of the report are provided in annex I below.

4. The report was prepared through: (i) the compilation of information available in third and fourth national reports; (ii) submissions made by Parties, other Governments and organizations in response to notification SCBD/STTM/JM/JLe/rg/77411 (2011-167), issued on 7 September 2011; (iii) research for additional information and relevant documents; and (iv) a synthesis of all the compiled information.

## III. IMPACTS OF ANTHROPOGENIC UNDERWATER NOISE ON MARINE AND COASTAL BIODIVERSITY

5. Pursuant to paragraph 12 of decision X/29, the Executive Secretary prepared a report compiling and synthesizing available scientific information on anthropogenic underwater noise and its impacts on marine and coastal biodiversity and habitats (UNEP/CBD/SBSTTA/INF/12). The key messages of the report are provided in annex II below.

6. A draft of the report was circulated for peer-review by Parties, other Governments and organizations, through notification SCBD/STTM/DC/RH/VA/78672 (2012-011), issued on 23 January, in particular secretariats of the Convention on Migratory Species, the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention), the Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS), and the International Whaling Commission (IWC), as well as International Maritime Organization (IMO).

7. On this issue, the Convention on Migratory Species adopted a resolution which is provided in annex V below for the information of Parties.

#### **IV. PROGRESS REPORT ON THE JOINT EXPERT MEETING ON ADDRESSING BIODIVERSITY CONCERNS IN SUSTAINABLE FISHERY**

8. Pursuant to paragraph 53 of decision X/29, the Executive Secretary convened a joint expert meeting on addressing biodiversity concerns in sustainable fishery, including the impacts on marine and coastal biodiversity of pelagic fisheries of lower trophic levels, in collaboration with FAO, UNEP and IUCN-CEM-FEG, in Bergen, Norway, from 7 to 9 December 2011. The main outcomes of the meeting are summarized below. Further details may be found in the full report of the meeting (UNEP/CBD/SBSTTA/INF/13).

9. The meeting agreed on seven overarching conclusions including:

(a) Fisheries affect biodiversity at all levels. The most significant issues are those failures or absence of management that have not achieved sustainable use and nor ensured that impacts of fisheries on biodiversity are within safe ecological limits;

(b) Fisheries management agencies have been aware of, and to varying extents working on, these biodiversity considerations for some time. The FAO Code of Conduct and its supporting documents, in particular the FAO guidelines on the ecosystem approach to fisheries management (EAF), recognize the importance of explicitly including ecosystem considerations in fisheries management. If the guidance in these documents was fully implemented, biodiversity considerations would be better addressed;

(c) Notwithstanding progress that has been made on addressing some biodiversity impacts relative to some fisheries, there is still a long way to go before achieving full implementation of the guidance referred to in the above paragraph (b);

(d) Fisheries management bodies at all levels are the right bodies to be responsible for managing fisheries, including the impacts of fisheries on biodiversity. However, there is a need for: (i) enhanced capacity of these fisheries-management agencies; (ii) constructive interagency collaboration; and (iii) full and meaningful participation of a wide range of biodiversity experts and relevant stakeholders in the fisheries management process;

(e) There is a need for enhancement of the mandates of the governance and assessment components of fisheries management bodies where this has not already happened, so biodiversity considerations are explicitly a core part of their work and accountability, not just mentioned in their mandates. There also has to be an overall will and resources to enable fisheries management agencies to deliver their full mandate;

(f) Regional cooperation among fisheries (and other) agencies becomes even more important as mandates are enhanced;

(g) Appropriate approaches for addressing biodiversity considerations in fisheries management will be situation specific and depend greatly on the capacities and information available. The management agencies should always use the best available information, and substantial progress can be made even in very data-limited situations.

11. The meeting discussed the particular roles for the Convention on Biological Diversity in addressing biodiversity concerns in sustainable fishery management, including:

(a) The Convention on Biological Diversity can promote and encourage an improved environment for good collaboration among biodiversity conservation experts and fisheries experts;

(b) The Convention and its networks of experts have expertise in biodiversity assessments and in selecting practical indicators for status and trends in biodiversity. The Convention can make this expertise available to fisheries assessment and management agencies;

(c) The expert community of the Convention on Biological Diversity can contribute to modelling work and other studies of longer term ecosystem-scale changes due to climate change,

aggregate impacts of multiple uses, and other scenarios. Their results can be made available to the sectoral regulatory agencies, including fisheries agencies, when they are dealing with factors such as the robustness of harvesting strategies;

(d) The Convention should be vigilant for opportunities to initiate or support pilot projects where these different communities can come and work together, and illustrate the concrete benefits of collaboration;

(e) The Convention can be a major contributor of expertise to capacity-building initiatives for any agency, including fisheries management agencies, dealing with biodiversity considerations.

12. The meeting reached the following conclusions on the impacts on marine and coastal biodiversity of pelagic fisheries of lower trophic levels:

(a) Small pelagic fish of lower trophic levels play an important role in marine ecosystems by providing links between lower and higher trophic levels. They feed primarily on zooplankton, and they are themselves eaten by larger fish as well as seabirds and marine mammals. Most low trophic level species are relatively small (typically less than 30 cm), have short life spans and their recruitment and population dynamics are strongly driven by short-term variability as well as long-term change in the environment;

(b) The differences between “high” and “low” abundance can be two orders of magnitude or more. When both fishing and natural variation interact to influence population abundance, populations can fall to 1/1000 of their peak abundance before recovering. Recovery is usually a response to reduced fishing mortality and/or favorable environmental conditions;

(c) Available science suggests that fluctuations in small pelagic fish species are primarily driven by the environment but that ineffectively managed fisheries can hasten or intensify collapses;

(d) Several species and types of small pelagic fish commonly co-occur forming quite complex systems, particularly in their response to environmental drivers. Data shows strongly differential responses and sometimes switching;

(e) According to FAO statistics, small pelagics make up about 40% (36 million tonnes in 2008) of global fisheries landings. Clupeoids (herring, sardines and anchovies) contribute more than half of this;

(f) Markets for fishery products on stocks of small pelagics have been variable, and when markets for the products are high, fishing pressure on these stocks can increase substantially;

(g) For widely-distributed pelagic stocks, use of the ecosystem approach to management, including application in fisheries, involves broader ecosystem assessment (including human drivers and social aspects) as a basis for credible scientific advice to inform adaptive management. Management of fisheries for small pelagics need to be an integral part of the broader ecosystem approach to the management of identified large marine ecosystems.

## **V. JOINT EXPERT REVIEW PROCESSES TO MONITOR AND ASSESS THE IMPACTS OF OCEAN ACIDIFICATION ON MARINE AND COASTAL BIODIVERSITY**

13. Pursuant to paragraph 66 of decision X/29, the Executive Secretary convened a meeting for a joint expert review process on the impacts of ocean acidification, in collaboration with Intergovernmental Oceanographic Commission/UNESCO, in Montreal, on 19-20 October 2011. The main outcomes of the meeting are summarized below. Further details may be found in the full report of the meeting (UNEP/CBD/SBSTTA/16/INF/14).

14. The meeting concluded that a phased expert review process should be implemented, including the following steps:



(a) **For the current biennium** for the sixteenth meeting of SBSTTA (May 2012) and the eleventh meeting of the Conference of the Parties (October 2012):

- (i) **Preparation of a simple scientific update summary document:** This document will capture key advances in scientific understanding and assessment made since the preparation of the CBD Technical Series No. 46 in a short document, and will list other important syntheses that have been recently prepared. The document will focus on key changes in knowledge that have occurred since 2009;
- (ii) **Preparation of draft elements, as described in annex III to this note, which can be considered as guidance for Parties to the Convention on practical responses to ocean acidification (OA):** This guidance will draw on existing science to indicate potential response mechanisms and actions that may be taken by individual countries to address impacts of ocean acidification on marine and coastal biodiversity.

(b) **For the next biennium or SBSTTA in mid-2013 and the twelfth meeting of the Conference of the Parties (2014):**

**Preparation of a systematic review of ocean acidification impacts on biodiversity and ecosystem functions:** This document will provide a targeted synthesis of the biodiversity implications of ocean acidification for marine and coastal systems, to include information on the less-reported paleo-oceanographic research. The document will provide an update to the biodiversity impacts documented in the CBD Technical Series No. 46, produced in 2009. A reduced emphasis on contextual and introductory information is proposed to streamline this document. It is anticipated that this process would lead to, or could provide opportunities for, the preparation of a peer-reviewed scientific publication.

15. The meeting explored mechanisms by which the Convention on Biological Diversity might support the advancement of key scientific needs and limitations. Discussions included:

- (a) The need to enable collaboration among ocean acidification (OA) research scientists across basin-scales to more effectively capture the interconnected nature of ecosystems. It was considered that such “internationalization” would be transformative not only for research on ocean acidification, but also for marine protected areas and other science issues related to marine biodiversity;
- (b) The need to raise awareness among Parties of new technologies that can drive down the cost of effective OA monitoring and assessment (e.g., automated monitoring equipment) and encourage strategic investment in technology and the application of these technologies in the developing countries;
- (c) The need to advocate the importance of establishing and maintaining long-term datasets for monitoring and assessment of ocean acidification that examine changes in community structure through space and time;
- (d) The need to ensure that biological observations are included alongside geochemical observations in global data-sharing mechanisms and collaborations. The framework and variables in preparation on this issue following the Ocean Observations meeting in 2009 were highlighted, and participants were encouraged to provide input on biological observations into the on-going effort to establish a coordinated ocean-acidification monitoring network;
- (e) Support capacity-building for research in developing countries and ensure that these countries are able to manipulate the available tools to better understand the local implications of ocean acidification. The use of exchange programmes to translate effective actions from other areas was encouraged;
- (f) Facilitate the involvement of indigenous and local communities;

(g) Support the engagement of developing country Parties in OA research and monitoring activities, through the effective mobilization of focal points for the Convention and for the United Nations Environment Programme (UNEP) Regional Seas to identify appropriate national-level experts.

## **VI. ADDRESSING IMPACTS OF HUMAN ACTIVITIES**

16. Pursuant to paragraph 69 of the same decision, the Secretariat of the Convention on Biological Diversity collaborated with the Scientific and Technical Advisory Panel of the Global Environment Facility (GEF-STAP) on the impacts of marine debris on marine and coastal biodiversity, and the contribution by GEF-STAP is available in document UNEP/CBD/SBSTTA/16/INF/15.

17. Key messages of GEF-STAP Advisory Document on marine debris, circulated at GEF Council meeting in May 2011<sup>1</sup> are provided in annex IV below, regarding the impacts on marine biodiversity.

18. Collaboration with other relevant organizations in this regard is under way.

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<sup>1</sup> GEF/C.40/Inf.14

*Annex I*

**PROGRESS MADE IN THE IMPLEMENTATION OF THE SPECIFIC WORKPLAN ON  
CORAL BLEACHING**

**STATUS AND TRENDS OF CORAL BLEACHING**

1. **Since the global mass coral bleaching event in 1998 there have been a number of severe regional-wide bleaching events around the world** with extensive bleaching of corals and high levels of mortality. The two outstanding bleaching events were the bleaching of the Caribbean in 2005 and the 2010 event centered around the Southeast Asia and the Coral Triangle which was reported as one of the most severe recorded. Almost 40% of coral reefs globally had experienced thermal stress levels high enough to cause a severe bleaching event up to 2007.
2. **Climate change will increase the severity and incidence of coral bleaching throughout tropical seas in 21<sup>st</sup> century.** Future projections indicate that the majority (98%) of the world's coral reefs will experience bleaching events at least once every five years by the end of this century.
3. **Both local and global stressors can compound the effects of bleaching on coral reefs.** Increasing levels of CO<sub>2</sub> will reduce coral survivorship and growth through the effects of warming (bleaching) and acidification respectively. This in turn will decrease reef resilience by reducing the threshold at which local stressors such as herbivore overfishing and nutrification drive coral reef communities from a coral-dominated to an algal-dominated state. Bleached corals also appear to be more susceptible to coral diseases which are increasing in prevalence and geographic distribution.

*Progress made in the implementation of the Specific Work Plan on Coral Bleaching*

*Management actions and strategies to support reef resilience, rehabilitation and recovery*

4. **Considerable progress has been made to enhance reef resilience** through the development of resilience assessment protocols, toolkits and frameworks. There has been a concerted effort to better understand reef resilience and develop management actions or strategies to enhance resilience and support reef rehabilitation and recovery. Resilience principles have been applied to coral reef management activities and incorporated into the design of new MPAs and networks in most coral reef regions around the world. However, there are still large areas of reefs where resilience has not been quantified.
5. **Detailed coral bleaching response plans have also been developed and implemented** in a few locations such as the Great Barrier Reef and Florida. Guidance has also been provided to develop a more simplified version of a response plan for sites where implementation resources are limited.
6. **Climate change action plans for specific coral reef areas** have been developed and implemented by some countries such as Australia for the Great Barrier Reef (GBR). These plans can improve the understanding of climate change vulnerabilities and enable the identification and testing of adaptation strategies to build reef resilience.
7. **MPA coverage in tropical waters has increased considerably** since the adoption of the coral bleaching work plan. Globally, approximately 27% of coral reefs were located within some form of MPA by the end of 2010 although the area protected varies considerably between regions. However, their effectiveness in meeting conservation and management objectives is low in many coral reef regions.

*Information gathering*

8. There has been a **significant increase in the availability of information on the status and function of species and habitats within coral reef ecosystems** since the work plan was developed.
9. **Improved monitoring of coral reefs and coastal communities has generated both ecological and socio-economic data** that is fed into well-coordinated data management systems. The assessment and reporting of coral bleaching events has also markedly improved with bleaching observations stored in open access databases such as ReefBase.

10. Of particular note has been **the increase in the socio-economic monitoring of coastal communities that rely on coral reefs for food or income** through the Global Socioeconomic Monitoring Initiative for Coastal Management (SocMon). The SocMon Initiative has grown considerably over the last decade and has produced regional guidelines for the Caribbean, Western Indian Ocean, Southeast Asia, Pacific and South Asia. A global assessment of tropical coastal socio-economic conditions in 2008 was produced while a draft set of indicators to assess the community-level social vulnerability to climate change have recently been released for field testing.

11. **The ability to predict coral bleaching events through remote sensing and modelling of warming has improved dramatically.** Early warning systems are in place both at the regional and global level to alert coral reef managers of the likelihood of coral bleaching. The NOAA's Coral Reef Watch programme has continued to develop a range of tools to quickly identify areas at risk of bleaching. When bleaching conditions occur, these tools can be used to trigger bleaching response plans and support appropriate management decisions.

12. **Targeted research on coral bleaching** has been conducted by many research institutions and conservation-based organizations around the world. Scientific knowledge on coral bleaching was reviewed in some detail in 2009. Since the adoption of the work plan, researchers have broadened the field of investigation to include other climate change effects such as ocean acidification and the interaction between both global and more local stressors on coral reefs. A specific targeted research programme that has involved a considerable amount of work on coral bleaching is the Coral Reef Targeted Research for Capacity Building and Management Program (CRTR).

#### *Capacity-building*

13. **A number of partnerships** (e.g. the Resilience Network, IUCN CCCR) and community participation programmes (LMMA networks) have been set up or expanded since the adoption of the coral bleaching work plan. In addition to existing networks (e.g. ICRAN) these partnerships and programmes have increased the number of education and training opportunities to improve understanding of the causes of coral bleaching and the ecological and societal impacts of bleaching events, and also provide training in resilience assessment techniques.

14. **Multi-disciplinary approaches to coral reef research** have been successful in providing training for local researchers and conservation practitioners in coral reef regions whilst also developing guidance for managers and conducting much needed targeted research programmes.

15. **A range of tools, guides and protocols have also been developed in relation to coral bleaching and management** including the Reef Resilience (R<sup>2</sup>) toolkit, bleaching and resilience assessment protocols, coral bleaching response plans, climate change action plans for coral reefs and managers guides to coral bleaching. However, there are still many coral reef nations that have not yet developed or implemented resilience or bleaching protocols for assessment and management, although this is regarded as a priority by many Governments.

16. **Overall, the capacity of coral reef nations to manage coral bleaching events has increased since the adoption of the coral bleaching work plan.** However, the increase in national capacity varies considerably between nations and regions with some least developed nations still lacking the human and/or technical resources to implement coral reef management programmes that include measures to document and manage the effects of climate change stressors such as bleaching.

#### *Policy development and implementation*

17. There has been **improved recognition by Parties, other Governments and relevant regional organizations/initiatives of the need for integrated or ecosystem based marine and coastal area management incorporating marine, terrestrial, and climatic considerations** when undertaking activities such as MPA network development, land use planning and watershed management approaches; fisheries policy and the provision of alternative livelihoods for people relying on coral reef resources.

18. **Regional efforts to develop and implement policy** that contribute to the delivery of the coral bleaching work plan occur through the UNEP Regional Seas Programmes (RSP). Regional treaties or

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agreements that contribute to the protection of coral reef ecosystems are in place in a number of regions for programmes on MPA networks, land-based pollution and climate change impacts.

19. The vulnerability of coral reef ecosystems to anthropogenic stressors and the importance of coral reefs to humanity have been recently recognized by the United Nations General Assembly Resolution 65/150 on the protection of coral reefs for sustainable livelihoods and development and by the United Nations Secretary General's report.

#### *Financing*

20. Progress has been made to mobilize international programmes and mechanisms for financial and technical development assistance to address the causes and consequences of coral bleaching. Government programmes of some developed nations (e.g. the U.S. Coral Reef Conservation Program) have prioritized key stressors to improve reef resilience in national waters and overseas territories while the GEF and World Bank supported Phase One of the Coral Reef Targeted Research (CRTR) Program.

21. **Regional programmes** such as the Caribbean and Micronesian Challenges or the Coral Triangle Initiative have been successful in mobilizing funds from a variety of sources including overseas aid from developed nations, development banks and the private sector. As well as direct donor or Government funding for project implementation there are concerted efforts to ensure the financial sustainability of the initiatives over the long-term through the formation of trust funds.

22. **Innovative financing mechanisms** have also been established to provide funding for large-scale approaches, particularly in the Pacific. The Phoenix Islands Protected Area (PIPA) is partly financed by an innovative "reverse fishing license" which funds an endowment to cover core management costs and compensate the government for the foregone commercial fishing license revenues. The Palau Green Fee, a tax that tourists pay when leaving the country is being used by community-based conservation groups to help manage the Protected Areas Network.

#### *Barriers to implementation*

23. **Mass coral bleaching events are a relatively 'new' phenomenon and there are still many gaps in our knowledge and understanding of bleaching effects and impacts.** There are still many questions being asked by researchers and conservation practitioners that will take time, and sufficient funding, to answer. Furthermore, we are not only dealing with the effects of increasing sea surface temperatures but also with ocean acidification and the interaction between these two climate change stressors and other more localised threats such as overfishing or eutrophication.

24. **Baseline information for coral reef ecosystems such as benthic cover or reef fish data is lacking in many regions making accurate resilience assessments of reefs more difficult.** Where monitoring data is being collected it often remains at a 'standard' level to assess coral reef status and has not been expanded to incorporate resilience criteria.

25. **The scientific knowledge of resilience in coral reefs is still at an early stage** and uncertainties in our understanding make it more difficult to design resilience-based spatial management systems involving MPAs. The existing knowledge of resilience-based management and planning approaches is also relatively new with approaches only tested in a few locations.

26. **A number of challenges in the practical management of coral bleaching** were identified. There was a lack of understanding and perception of concepts such as resilience by reef managers and the interaction between global and local threats in enhancing the resilience of coral reefs. In addition many communities have not fully accepted the reasoning behind conservation tools such as MPAs and are reluctant to assimilate further resilience-based mechanisms.

27. **Insufficient capacity** in developing nations to fully implement the specific work plan, or effectively manage coral reefs without even considering climate change impacts, remains a key barrier. Combined training and awareness programmes in reef resilience assessment and management have been provided in some regions in a few locations but need to be an integral part of national climate change action plans with adequate support through various partnerships.

28. **Financing** the required level of support to address climate change impacts on coral reefs through the implementation of the specific work plan is, along with the capacity issue, the most important obstacle to progress. One barrier highlighted is the lack of a contingency fund that can be quickly accessed to support a rapid response to mass bleaching events. It is also important to ensure that funding continues after bleaching events for ongoing monitoring to document secondary effects (e.g. coral disease outbreaks) and support long-term management goals.

*Specific actions undertaken to mobilize financial resources required for implementation*

29. Specific actions included conducting in-depth discussions with Governments to secure adequate research funding for bleaching and resilience related work, liaising with partner organizations to provide match funding, and applying for international grants such as those provided by NOAA's CRCP. The setting up of endowment funds to finance regional approaches such as the Micronesia Challenge was highlighted as were the formation of sustainable finance plans and the establishment of National Climate Funds.

30. **Other potential sources of funding for activities directly or indirectly related to the work plan implementation** included multilateral climate change adaptation funds predominantly managed by UNFCCC, GEF and the World Bank and also unilateral climate funds. More market-based financial resources, such as Payment for Ecosystem Services (PES) or blue carbon schemes for coastal carbon sink ecosystems are currently in their infancy but expected to provide significant funding within the next decade. There is also considerable potential to increase the involvement of the private sector, particularly tourism, in tropical coastal ecosystem management through direct funds, incentives, compensation payments or user fees. Other financing mechanisms are the use of environmental bonds for climate resilience and adaptation projects such as the World Bank Green Bond; the polluter pays principle (PPP) for both chronic and acute pollution of coral reef ecosystems and green taxes similar to the green fee system in Palau.

*Conclusions and future priorities*

*Information generation*

31. **There is a need to improve and simplify tools and guidance for managers on reef resilience indicators and methodologies** to assess vulnerability, resilience and adaptation opportunities for dependent communities. Some of the current resilience assessment protocols are quite data intensive and require a high level of expertise. A more simplified but still scientifically accurate assessment protocol with reliable and 'user-friendly' resilience indicators can help to increase the uptake of resilience-based assessments and increase the area of coral reef assessed.

32. **Greater emphasis is needed to evaluate and quantify the socio-ecological impacts and implications of repeated mass bleaching events.** The long-term effect of bleaching episodes compounded by other stressors (both local and global threats) is a key area that requires immediate and systematic investigation through research and assessment programmes. In terms of global impacts related to climate change, extensive information is needed for ocean acidification impacts but also for other effects such as tropical storm incidence and severity and sea level rise.

33. It is important to **determine and quantify the linkages between ecological and social variables and also the inter-relationship between ecological responses to bleaching (and other stressors) and the vulnerability of dependent communities and industries.** Quantifying or accurately predicting the socio-economic effects of coral reef degradation on coastal communities and other stakeholders will assist in effective adaptation planning.

34. **Continued support to global initiatives to document and report on status and trends on coral reefs as an aide to national decision-making is needed.** Expansion of monitoring efforts at the national and regional level to include previously un-assessed coral reef areas and make monitoring more systematic will help to identify both resilient areas and those most in need of strong management.

*Practical management*

35. **Coral-reef management should be conducted within an integrated ecosystem-based approach** that considers the full range of impacts that a particular reef system is subjected to and seeks to address the underlying drivers of localised threats both on land and at sea. Management needs to consider not just rising sea temperatures and coral bleaching events but also the effects of ocean acidification, tropical storms and increased sea level and the interaction between these.

36. There should be **greater integration of resilience principles into management planning at the national and regional level**. National coral reef action plans need to be in place for all coral reef countries that incorporate climate change effects and resilience-based approaches and are regularly updated to represent current scientific knowledge. Management of coral bleaching events in many countries can be improved if there are coral bleaching response plans in place. Support should be provided to develop and ensure the effective implementation of integrated ecosystem-based management approaches for coral reefs and associated ecosystems.

*Capacity-building*

37. **There is still a great need to improve capacity to manage coral bleaching and other stressors on coral reefs across a range of scales**. Firstly, there needs to be greater exchange of scientific, technical, and socio-economic information as it relates to coral reef degradation. Key scientific knowledge and management experiences should be available to coral reef managers in all countries to enable informed decision-making. Resilience training that encompasses all potential climate change effects on coral reefs for that country or region needs to be developed, tested and disseminated. Where successful management approaches are identified for areas such as coral reef protection, resilience building, adaptation and the use of new technologies, they should be shared both within countries and at the regional level through exchange programmes. These best practices need to be incorporated into both national and regional governance frameworks and reef management strategies.

38. **Training programmes need to include a substantial educational component to increase the understanding of new and established concepts for effective reef management**. Increased support for coral reef action networks and other partnerships focussed on addressing the key issues for coral reefs and their management is required. There also needs to be better coordination of coral reef between different levels (local, provincial, national) and between the various agencies (government, non-government, community) to improve monitoring and management effectiveness.

*Financing*

39. A key priority is to **establish a readily accessed contingency fund to enable more rapid and increased reef monitoring in response to bleaching events**. Rapid provision of funds is essential to activate bleaching response plans so that a thorough assessment of the event can be carried out.

40. The projected increase in severe bleaching events in the near future emphasises the need for increased levels of financing as climate change and other localized impacts become more common and intense. **The funding base for coral reef management needs to be expanded and diversified**. Innovative and diverse financing mechanisms, especially linked to the private sector, should be supported. Climate change funding for adaptation of tropical coastal communities also needs to be increased either via existing multilateral climate funds or through the establishment of national climate funds.

*Policy frameworks*

41. **There is a need to improve linkages between agencies such as the Secretariat of the Convention on Biological Diversity, the Secretariat of UNFCCC and FAO** to enhance regional and international efforts to address the negative effects of climate change on marine biodiversity, ecosystem services and dependent populations.

42. **Further regional initiatives and agreements and transboundary collaboration should also be encouraged and supported**. Regional or national policies to address localised threats are still lacking in some cases and should be prioritised through support for policy development in those countries or

regions. The success of regional initiatives such as the Micronesia Challenge has shown how useful partnerships are to tackle issues at the national and regional scale. Further partnerships to set regional policy can initiate improved management of coral reefs.



*Annex II*

**IMPACTS OF ANTHROPOGENIC UNDERWATER NOISE ON MARINE AND COASTAL BIODIVERSITY**

*Introduction and background*

1. **The underwater world is subject to a wide array of human-made noise from activities such as commercial shipping, oil and gas exploration and the use of various types of sonar.** Human activity in the marine environment is an important component of oceanic background noise and can dominate the acoustic properties of coastal waters and shallow seas. Human activities introduce sound into the marine environment either intentionally for a specific purpose (e.g., seismic surveys) or unintentionally as a by-product of their activities (e.g., shipping or construction). Anthropogenic noise can be broadly split into two main types: impulsive and non-impulsive sounds. The level of human activity and corresponding noise production in the marine environment is predicted to rise over the coming decades as maritime transportation and the exploration and extraction of marine resources continues to grow.

2. **Anthropogenic noise in the marine environment has increased markedly over the last 100 or so years as the human use of the oceans has grown and diversified.** Technological advances in vessel propulsion and design, the development of marine industry and the increasing and more diverse anthropogenic use of the marine environment have all resulted in a noisier underwater realm. Long-term measurements of ocean ambient sound indicate that low frequency anthropogenic noise has been increased, primarily due to commercial shipping. As well as an increase in commercial shipping the last half century has also seen an expansion of industrial activities in the marine environment including oil and gas exploration and production, commercial fishing and more recently the development of marine renewable energy. In coastal areas the increase in the number of small vessels is also a cause for localised concern where they can dominate some coastal acoustic environments such as partially enclosed bays, harbours and estuaries.

3. **Anthropogenic noise has gained recognition as an important stressor for marine life and is now acknowledged as a global issue that needs addressing.** The impacts of sound on marine mammals have received particular attention, especially the military's use of active sonar, and industrial seismic surveys coincident with cetacean mass stranding events. Extensive investigation mainly over the last decade by academia, industry, government agencies and international bodies has resulted in a number of reviews of the effects of sound on marine fauna. The issue of underwater noise and its effects on marine biodiversity has received increasing attention at the international level with recognition by a number of international and regional agencies, commissions and organisations including the Convention of Migratory Species (CMS), the International Whaling Commission (IWC), the United Nations General Assembly (UNGA) and the United Nations Convention on the Law of the Sea (UNCLOS), the European Parliament and European Union, the International Union for Conservation of Nature (IUCN), the International Maritime organization (IMO), the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic and the Convention on the Protection of the Marine Environment of the Baltic Sea Area (HELCOM).

*The importance of sound to marine animals*

4. **Sound is extremely important to many marine animals and plays a key role in communication, navigation, orientation, feeding and the detection of predators.** The distinctive properties of underwater sound and the limitations of other senses such as vision, touch, taste and smell in the marine environment in terms of range and speed of signal transmission mean that sound is the preferential sensory medium for a large proportion of marine animals. Almost all marine vertebrates rely to some extent on sound for a wide range of biological functions. Marine mammals use sound as a primary means for underwater communication and sensing. They emit sound to communicate about the presence of danger, food, a conspecific or other animal, and also about their own position, identity, and reproductive or territorial status. Many other marine taxa also rely on sound on a regular basis including

teleost fish and invertebrates such as decapod crustaceans. Fish utilize sound for navigation and selection of habitat, mating, predator avoidance and prey detection and communication. Impeding the ability of fish to hear biologically relevant sounds might interfere with these critical functions. Although the study of invertebrate sound detection is still rather limited, based on the information available it is becoming clear that many marine invertebrates are sensitive to sounds and related stimuli. However, the importance of sound for many marine taxa is still rather poorly understood and in need of considerable further investigation.

#### *The impacts of underwater noise on marine biodiversity*

5. **A variety of marine animals are known to be affected by anthropogenic noise.** Negative impacts for least 55 marine species (cetaceans, teleost fish, marine turtles and invertebrates) have been reported in scientific studies to date.

6. **A wide range of effects of increased levels of sound on marine fauna have been documented** both in laboratory and field conditions. The effects can range from mild behavioural responses to complete avoidance of the affected area, masking of important acoustic cues, and in some cases serious physical injury or death. Low levels of sound can be inconsequential for many animals. However, as sound levels increase the elevated background noise can disrupt normal behaviour patterns leading to less efficient feeding for example. Masking of important acoustic signals or cues can reduce communication between con-specifics and may interfere with larval orientation which could have implications for recruitment. Some marine mammals have tried to compensate for the elevated background noise levels by making changes in their vocalizations. Intense levels of sound exposure have caused physical damage to tissues and organs of marine animals, and can lead to mortality, with lethal injuries of cetaceans documented in stranded individuals caught up in atypical stranding events. Lower sound levels have been shown to cause permanent or temporary loss of hearing in marine mammals and fish. Behavioural responses such as strong avoidance of the sound source can lead to habitat displacement. Some marine animals, such as beaked whales are particularly susceptible to anthropogenic sound, and some populations have experienced declines for years after a sonar-induced stranding event.

7. **There are increasing concerns about the long-term and cumulative effects of noise on marine biodiversity.** The long-term consequences of chronic noise pollution for individuals and populations are still mainly unknown. Potential long-term impacts of reduced fitness and increased stress leading to health issues have been suggested. There is also growing concern of the cumulative effects of anthropogenic sound and other stressors and how this can affect populations and communities. Although there is currently little empirical evidence for noise effects on marine populations, acoustic studies for terrestrial vertebrates indicate that features such as fitness and reproductive success can be compromised. The additional threat of living in a noisy environment may push already highly stressed marine animals into population decline with subsequent effects on marine communities and biodiversity.

#### *Acoustic research and future research needs*

8. **Research is required to better understand the impacts of anthropogenic sound on marine biodiversity.** The lack of scientific knowledge regarding the issue is also one of the most important limitations for effective management at the present time. There are high levels of uncertainty for noise effects on all marine taxa. Detailed research programmes of noise effects on species, populations, habitats and ecosystems plus also cumulative effects with other stressors need to be put in place or consolidated where they already exist. However, the extensive knowledge gaps also mean that prioritization will be required. Recommended priorities for research include species that are already highly threatened, endangered or particularly vulnerable through a combination of multiple stressors and intrinsic characteristics, but also representative groups of understudied taxa. Current knowledge for some faunal groups such as teleost fish, elasmobranch fish, marine turtles, seabirds and invertebrates is particularly lacking. Other priorities for acoustic-related research are the identification and protection of critical habitats that endangered or threatened marine species depend upon for important activities such as foraging or spawning. Marine species that support commercial fisheries should also be assessed for

susceptibility to noise pollution and the issue of anthropogenic noise considered for fisheries management plans.

### *Management and mitigation of underwater noise*

9. **There is a need to scale up the level of research and management efforts, to significantly promote greater awareness of the issue and to take measures minimize our noise impacts on marine biodiversity.** A number of current or proposed large-scale research programmes are addressing a range of issues with a focus on marine mammals. Existing or proposed management frameworks involving noise pollution also need to be tested and refined accordingly in a range of scenarios.

10. **Effective management of anthropogenic noise in the marine environment should be regarded as a high priority for action at the national and regional level** through the use of up to date mitigation measures based on the latest scientific understanding of the issue for marine species and habitats. Mitigation and management of anthropogenic noise through the use of spatio-temporal restrictions (STR) of activities has been recommended as the most practical and straightforward approach to reduce effects on marine animals. A framework for the implementation of STR's is available for use by national and regional bodies to ensure that acoustic issues are considered in future marine spatial planning.

11. **Mitigation of marine noise in the oceans** is in place for industrial and military activities in some regions of the world through the use of measures and guidelines. However, critical analysis of this guidance has identified a number of significant limitations including the considerable variation in standards and procedures between regions or navies. Mitigation of anthropogenic sound levels in the marine environment require regular updating to keep in touch with changes in acoustic technology and the latest scientific knowledge of marine species such as acoustic sensitivity and population ecology. There have been calls for the setting of global standards for the main activities responsible for producing anthropogenic sound in the oceans. Progress is being made with regard to commercial shipping and quieting but standards for naval sonar or seismic surveys are also required to reduce impacts on marine species.

### *New challenges*

12. **New challenges such as global changes in ocean parameters** (e.g. acidity and temperature) are also likely to have consequences for marine noise levels at a range of geographic scales through changes in sound absorption and the retreat of Arctic sea ice opening up waters for exploration and resource extraction. Preliminary modelling of projected changes in acidity caused by ocean acidification suggests that particularly noisy regions that are also prone to reduced sound absorption should be recognized as hotspots where mitigation and management is probably most needed. Further research is needed to confirm these predictions. Previously, relatively quiet areas of the oceans such as the Arctic are also highly likely to be exposed to increased levels of anthropogenic sound as the sea ice coverage decreases, through exploration and exploitation, with potentially significant effects on marine biodiversity. Management frameworks for the Arctic need to consider anthropogenic noise as an important stressor alongside others when deciding the extent of activities permitted in these waters.

*Annex III***PRACTICAL RESPONSES TO ADDRESS OCEAN ACIDIFICATION**

1. The following are edited elements, suggested by the Expert Meeting to Develop a Series of Joint Expert Review Processes to Monitor and Assess the Impacts of Ocean Acidification on Marine and Coastal Biodiversity (Montreal, 19-20 October 2011), as guidance to support Parties to the Convention in the realization of practical responses to ocean acidification impacts on marine and coastal biodiversity. These suggested elements are in recognition of Aichi Biodiversity Target 10: *by 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimised, so as to maintain their integrity and functioning.*

**CO<sub>2</sub> emission reductions**

2. Chemical changes associated with anthropogenic ocean acidification are irreversible on timeframes of at least hundreds of years and biological changes could last even longer. Substantial damage to ocean ecosystems can only be avoided through urgent and rapid reductions in global emissions of CO<sub>2</sub>.

3. Parties to the Convention are encouraged to work towards effective CO<sub>2</sub> emission reductions; and to facilitate the participations of relevant biodiversity-related expertise in UNFCCC, IPCC and other related processes.

**Maintaining and restoring ecosystem resilience**

4. Multiple stressors affect marine biodiversity, often through additive impacts. In addition to significant reductions in emissions, adaptation-based measures will be required to respond to acidification. While mitigation involves a global commitment, adaptation actions can be adopted at the local, national and international levels as part of broader efforts to preserve and maintain marine ecosystems, and support the communities and peoples who depend on those ecosystems and the services they provide. Decreasing the impacts of other stressors is critical to maintain ecosystem resilience. Local, subnational or national laws in many countries may already be in place to address many stressors that drive or exacerbate acidification conditions.

5. Parties are encouraged to adopt and enforce national level policies to facilitate ecosystem resilience, such as:

(a) Effective watershed and coastal management to reduce runoff with associated organic matter and pollutants (including storm water surge prevention, maintaining intact wetlands, improved water treatment facilities) to limit the exacerbating impacts of eutrophication on localized acidification;

(b) Control of coastal erosion to reduce nutrient and sediment loading of water and protect physical integrity of habitats (including increasing vegetation cover, coordination among local and municipal governments for watershed-scale action);

(c) Land-use management through local and regional planning, zoning and permitting to reduce direct and indirect carbon dioxide emissions, runoff and other threats;

(d) Reduction of local pollutants through source control of persistent pollutants and enforcement of existing emissions limits for non-persistent pollutants;

(e) Identify and protect resilient ecosystems through effectively and actively managed marine and coastal protected areas;

(f) Prevent the further loss and degradation of coastal ecosystems and catalyse their recovery through restoration and management;

(g) Implement ecosystem-based fisheries management to limit the impacts of destructive fishing practices (e.g. bottom-trawling) and other physical pressures and disturbances to ecosystems, and avoid overfishing;

(h) Recognize the roles of indigenous and local communities in maintaining and restoring ecosystem resilience, and provide resources and tools to support adaptation that maintains essential ecosystem services upon which societies depend.

6. Parties are also encouraged to incorporate emerging scientific knowledge on ocean acidification into national biodiversity strategies and action plans (NBSAPs) as well as strategies and action plans for mitigation of and adaptation to climate change, national and local plans on integrated marine and coastal area management, and the design and management of marine and coastal protected areas, and to include with NBSAPs, specific measures to deal with ocean acidification. Related capacity-development needs should be communicated to the Secretariat of the Convention.

### **Communications and outreach**

7. Effective communication is one important tool to encourage the design and implementation of plausible solutions to ocean acidification. To date – outside of the ocean acidification scientific community, – the ocean acidification issue has not been adequately communicated in a manner to warrant significant action by impacted sectors and stakeholders.

8. Parties are encouraged to:

(a) Facilitate communication of ocean acidification issues at the local, national, and international levels;

(b) Coordinate at regional levels for information and knowledge sharing and convene relevant stakeholders to consider this issue;

(c) Support capacity-building and training for communication of ocean acidification across key sectors;

(d) Share case-studies of where ocean acidification impacts are already observed and can be confidently attributed (natural and anthropogenically induced acidification).

### **Contributing to scientific knowledge generation**

9. The global scale of ocean acidification means that concerned Parties need to work together to address knowledge gaps. Careful coordination of knowledge requirements with the future national research plans will help reduce redundancy and improve coverage of under-represented ecosystems. Important networks already exist which seek to coordinate international research efforts, synthesize available knowledge, and enable inter-comparison of scientific data. Parties to the Convention are encouraged to:

(a) Engage actively in existing networks and platforms to share data and observations related to ocean acidification;

(b) Apply global best practices in the monitoring and assessment of ocean acidification;

(c) Inform the Secretariat of the Convention on Biological Diversity of existing ocean acidification activities and research to support improved understanding of capacities, resources and under-represented geographies.

*Annex IV***KEY MESSAGES EXTRACTED FROM GEF-STAP ADVISORY DOCUMENT ON MARINE DEBRIS: DEFINING A GLOBAL ENVIRONMENTAL CHALLENGE, REGARDING THE IMPACTS OF MARINE DEBRIS ON MARINE AND COASTAL BIODIVERSITY**

1. **Marine habitats are contaminated with man-made items of debris from the poles to the equator and from shorelines, estuaries and the sea surface to the depths of the ocean.** While the types and absolute quantities vary, there is no doubt about the ubiquity of debris on a truly global scale. Such debris can be harmful to wildlife and to human health; has the potential to transport organic and inorganic contaminants; can present a hazard to shipping; and can be aesthetically detrimental. In addition to having consequences for biodiversity and potential indirect effects on ecosystem goods and services, marine debris have direct negative economic impacts in all coastal areas.

2. **Marine debris includes any form of manufactured or processed material discarded, disposed of or abandoned in the marine environment.** It consists of items made or used by humans that enter the sea, whether deliberately or unintentionally, including transport of these materials to the ocean by rivers, drainage, sewage systems or by wind. While this definition encompasses a very wide range of materials, most items fall into a relatively small number of material types and usage categories. Integrating across the UNEP Regional Seas reports, scientific papers, and government reports, it is readily apparent that plastic items consistently rank as being among the most abundant types of marine debris on a global.

3. **More than 260 species are already known to be affected by marine debris through entanglement or ingestion.** Ingestion by birds, turtles, fish and marine mammals is well documented and can be fatal. A wide range of plastic types are involved and the species affected range from entanglement of cetaceans in rope and netting, suffocation of birds and turtles by plastic film to ingestion of microscopic fragments of plastic by fish and invertebrates. Small particles are of concern because they may be ingested by a wide range of organisms and could have adverse physical effects, for example by disrupting feeding and digestion. Of the 120 marine mammal species listed on the IUCN Red List 54% are known to have been entangled in or have ingested plastic debris; 34 out of 34 green turtles and 14 of 35 seabirds found along the southern Brazilian seacoast, had ingested debris, with plastic being the main ingested material. In addition to ingestion and entanglement, beach debris that had washed up from River Asi, an international river passing through Lebanon, Syria and Turkey, has been shown to adversely affect the ability of green turtle hatchlings to reach the sea on the Samandag coast in Turkey. Evidence of harmful effects of plastic on wildlife is mostly restricted to observations on individuals that have become entangled in or have ingested plastic debris. There is as yet little evidence of effects on assemblages of species although concerns have been raised about potential consequences for ecosystem-wide impacts and ecosystem goods and services. Population level data for Northern Fulmar, *Fulmarus glacialis*, have shown that over 95% of birds washed ashore dead contained plastic in their gut, with many individuals having substantial quantities of plastic.

4. **Plastic debris has also been implicated in the transport of non-native invasive species which can raft considerable distances on floating debris.** Over 150 multi-cellular species have been reported associated with plastic debris, the majority being hard shelled species including bivalve mollusks, barnacles, tube worms, bryozoans, hydroids and coralline algae; and there is evidence that items of plastic washed ashore are often fouled by non native species. Some species of *Vibrio* bacteria were shown to grow preferentially on plastic particles in the ocean. While it is unknown whether those found can cause disease, the finding is of potential concern. There is also the potential for “rafting” on plastic debris to facilitate transport of species across boundaries of water masses that might otherwise be relatively impenetrable.

5. **Small particles are of concern because they may be ingested by a wide range of organisms and could have adverse physical effects, for example by disrupting feeding and digestion.** While the most visible types of plastic debris are large derelict fishing nets, bottles, bags, and other consumer

products, much of the debris collected during survey trawls consists of tiny particles or “microplastic”. Microplastics have accumulated in the water column, on the shoreline and in subtidal sediments. This material has been defined as pieces or fragments less than 5mm in diameter. A horizon scan of global conservation issues recently identified microplastic as one of the top global emerging issues. Microplastic is formed by the physical, chemical and biological fragmentation of larger items, or from the direct release of small pieces of plastic such as pre-production pellets and powders, and microscopic plastic particles that are used as abrasive scrubbers in domestic cleaning products and industrial cleaning applications such as shot blasting of ships and aircraft. Plastic items fragment in the environment because of exposure to ultraviolet light and abrasion, hence smaller and smaller particles form, but this material does not biodegrade. The quantity of fragments is therefore expected to increase in the seas and oceans.

6. **If the plastic particles break down into nano-sized particles, they may impact the bottom of the food web upon which the ocean and global climate depend.** It has been reported in a laboratory study, for example, that nanopolystyrene beads can inhibit photosynthesis and cause oxidative stress in algae. Fragments as small as 2µm have been identified from marine habitats around Singapore, but due to limitations in sampling and analytical methods the extent to which this type of debris has fragmented into nanoparticle-size pieces is unknown. As colloidal size particles, nanoplastic particles could be subject to different vertical transport mechanisms than larger fragments and more work is needed to understand the potential sinks where this material will accumulate. However, there is already clear evidence that small plastic fragments are the most common size fraction reported in oceanic gyres in the Pacific and Atlantic, with some of the highest densities being reported in the open ocean rather than in coastal waters adjacent to population centers. In some locations the abundance of small fragments in the water column is increasing.

7. **There is concern that small plastic fragments might present a toxicological challenge.** Plastics contain a variety of potentially toxic chemicals that are incorporated during manufacture (monomers and oligomers, bisphenol-A (BPA), phthalate plasticisers, flame retardants and antimicrobials). There is evidence regarding the potential for these chemicals be released to humans from plastic containers used for food and drink, plastic in medical applications, and in toys, and so there is the potential that these substances might also be released if plastics are ingested by marine organisms. While exposure pathways have not been determined, chemicals used in plastics such as phthalates and flame retardants have been found in fish, sea mammals, mollusks and other forms of marine life. This raises concerns about a potential for toxic effects. For example, BPA, for which there is evidence from laboratory studies of adverse effects on a variety of aquatic organisms, may enter the marine benthic environment from plastics that settle to the bottom of the sea. Phthalates have been shown in laboratory studies to have adverse effects on aquatic organisms. While a direct link between plastic marine debris and adverse effects on populations of marine organisms would be very difficult to demonstrate experimentally, if such effects were to occur they would be no way of reversing or remediating them due to the nature of marine debris accumulation in the environment.

8. **At present our understanding about the potential for plastics to adsorb, transport and release chemical contaminants is limited.** Studies in Japan demonstrated that plastic debris can adsorb persistent organic pollutants (POPs) from the ocean water and that within a few weeks these substances can become orders of magnitude more concentrated on the surface of plastic debris than in the surrounding water column. Basic thermodynamic equilibrium calculations indicate that over large ocean areas (e.g., between the tropics and the Arctic) transport of POPs adsorbed to plastics is insignificant compared with long-range transboundary fluxes with air and ocean waters. However there are concerns that for shorter distances and timeframes, plastics may short-circuit the long-term equilibrium processes resulting in the increased exposure. There are also concerns that as plastic particles become re-distributed in the water column and sediments they may carry adsorbed chemicals with them. Additional concern is that if a marine organism ingests plastic particles with adsorbed POPs, the POPs may subsequently be released into the gut.

11. **It is often difficult to separate these from a range of other anthropogenic factors influencing marine ecosystems but it is important to acknowledge marine debris as an important additional**

**degradation agent.** Addressing the impacts of marine debris on biodiversity will often be impractical using the same approaches adopted to reduce other human impacts such as over-exploitation and disturbance. The latter can be relatively efficiently regulated through the use of marine reserves, protected areas and integrated coastal zone management. The potential for plastic debris to travel considerable distances and to accumulate in habitats far from its point of origin presents a distinct challenge that is difficult if not impossible to resolve once the debris is adrift. Conservation methods based on spatial planning will be ineffective to deal with plastics debris in many settings.



*Annex V*

**UNEP/CMS/RESOLUTION 10.24: FURTHER STEPS TO ABATE UNDERWATER NOISE POLLUTION FOR THE PROTECTION OF CETACEANS AND OTHER MIGRATORY SPECIES**

Adopted by the Conference of the Parties at its Tenth Meeting (Bergen, 20-25 November 2011).

*Recalling* that in Resolution 9.19 the CMS Parties expressed concern about possible “adverse anthropogenic marine/ocean noise impacts on cetaceans and other biota”;

*Recalling* that in the meantime other international fora such as the:

- International Maritime Organization (IMO)
- International Whaling Commission (IWC)
- Convention for the Protection of the Marine Environment of the North-East-Atlantic (OSPAR)
- Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)
- Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic Area (ACCOBAMS)

have also recognized or continued to recognize man-made noise as a potential threat to cetacean conservation and welfare;

*Recalling* that the United Nations General Assembly in paragraph 107 of its Resolution 61/222 on "Oceans and the law of the sea", adopted on 20 December 2006 "encourages further studies and consideration of the impacts of ocean noise on marine living resources, and requests the Division\* to compile the peer-reviewed scientific studies it receives from Member States and to make them available on its website";

*Noting* in this context the following resolutions and papers adopted under other international fora during the last triennium:

- a. The Convention on Biological Diversity (CBD) COP Decision X/29 concerning marine and coastal biodiversity and in particular its paragraph 12 relating to anthropogenic underwater noise;
- b. ACCOBAMS MOP Resolution 4.17 “Guidelines to address the impact of anthropogenic noise on cetaceans in the ACCOBAMS area”;
- c. ASCOBANS MOP Resolution 6.2 “Adverse effects of underwater noise on marine mammals during offshore construction activities for renewable energy production”;
- d. The 2009 IMO Report “Noise from commercial shipping and its adverse impacts on marine life”;
- e. The 2008 OSPAR Guidance on environmental considerations for offshore wind farm development;
- f. IWC Consensus Resolution 2009-1 on Climate and other environmental changes and cetaceans; and

*Acknowledging* the ongoing activities in other fora to reduce underwater noise such as the activities of the IMO to delimit shipping noise, and activities within NATO to avoid negative effects of SONAR use;

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\* United Nations Secretariat Division for Ocean Affairs and Law of the Sea.

*The Conference of the Parties to the  
Convention on the Conservation of Migratory Species of Wild Animals*

1. *Reaffirms* that there is a need for ongoing and further internationally coordinated research on the impact of underwater noise (including inter alia from offshore wind farms and associated shipping) on cetaceans and other migratory species and their migratory routes and ecological coherence in order to give adequate protection to cetaceans and other marine migratory species;
2. *Confirms* the need for international, national and regional limitation of harmful underwater noise through management (including, where necessary, regulation), and that Resolution 9.19 remains a key instrument in this regard;
3. *Strongly urges* Parties to prevent adverse effects on cetaceans and on other migratory marine species by restricting the emission of underwater noise, understood as keeping it to the lowest necessary level with particular priority given to situations where the impacts on cetaceans are known to be heavy; and where noise cannot be avoided, urges Parties to develop an appropriate regulatory framework or implement relevant measures to ensure a reduction or mitigation of man-made underwater noise;
4. *Urges* Parties to ensure that Environmental Impact Assessments take full account of the effects of activities on cetaceans and to consider potential impacts on marine biota and their migration routes and consider a more holistic ecological approach already at a strategic planning stage;
5. *Recommends* that Parties apply Best Available Techniques (BAT) and Best Environmental Practice (BEP) including, where appropriate, clean technology, in their efforts to reduce or mitigate marine noise pollution; and further recommends that Parties use, as appropriate, noise reduction techniques for offshore activities such as: air-filled coffer dams, bubble curtains or hydro-sound dampers, or different foundation types (such as floating platforms, gravity foundations or pile drilling instead of pile driving);
6. *Encourages* Parties to integrate the issue of anthropogenic noise into the management plans of marine protected areas (MPAs) where appropriate, in accordance with international law, including UNCLOS;
7. *Invites* the private sector to assist in developing mitigation measures and/or alternative techniques and technologies for coastal, offshore and maritime activities in order to minimize noise pollution of the marine environment to the highest extent possible;
8. *Instructs* the Secretariat to draw this Resolution to the attention of the governing bodies of the CBD, UNCLOS, UNEP (Regional Seas Programmes, Governing Council), IMO and other relevant intergovernmental organizations, and to keep those bodies informed of progress in implementing this Resolution.

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