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Report of the

FAO/UNEP EXPERT MEETING ON IMPACTS OF DESTRUCTIVE FISHING PRACTICES, UNSUSTAINABLE FISHING, AND ILLEGAL, UNREPORTED AND UNREGULATED (IUU) FISHING ON MARINE BIODIVERSITY AND HABITATS

Rome, 23–25 September 2009

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PREPARATION OF THIS DOCUMENT

Following a decision by the Conference of the Parties to the Convention on Biological Diversity (CBD) at its ninth meeting (Bonn, 19–30 May 2008), the CBD Secretariat and FAO collaborated in the compilation of a report on the impacts of destructive fishing practices, unsustainable fishing, and illegal, unreported, and unregulated (IUU) fishing on marine biodiversity and habitats. A working document was first prepared for review and endorsement by an international Group of Experts, through an Expert Meeting which took place at FAO in Rome in late September 2009. Two consultants, William Cheung (in collaboration with Jonathan Anticamara) and John Caddy, were recruited to compile the information available on the issues of unsustainability and IUU on the one hand and destructive fishing on the other. Because of lack of time, the working document could not be finalized into a satisfactory fully integrated and comprehensive study and was therefore not endorsed by FAO, the United Nations Environment Programme (UNEP) or CBD. Nonetheless and in order to facilitate the work of the Expert Meeting, the working document was summarized and structured into an extended summary by Serge M. Garcia (Consultant) focusing on the key conclusions regarding the impacts and the main points of action for policy-making and management to be considered eventually by Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 14) and the Conference of the Parties (CoP 10). This report is the main output of the expert meeting and provides: (i) key conclusions on the impacts of unsustainable fishing, destructive fishing practices and IUU fishing on marine biodiversity and habitats; and (ii) elements of policy and management aiming at the mitigation, reduction and, where possible, elimination of the impacts of fisheries on biodiversity and habitats.

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ABSTRACT

An expert meeting on the impacts of destructive fishing practices, unsustainable fishing, and illegal, unreported, and unregulated (IUU) fishing on marine biodiversity and habitats was held in Rome from 23 to 25 September 2009. The meeting was attended by three members of the Fisheries Expert Group (FEG) of the Commission on Ecosystem Management (CEM) of the International Union for the Conservation of Nature (IUCN), three participants from the Secretariat of the Convention of the Biological Diversity (CBD) (two of which were consultants), one from the United Nations Environment Programme (UNEP), three international experts and eight participants form FAO headquarters.

The purpose of the Expert Meeting was to:

i. Review a synthesis document (extended summary) prepared in advance of the meeting, ensuring that all key issues were covered and that conclusions fully reflected the present understanding.

ii. Elaborate a report containing: (i) key conclusions on the impacts of unsustainable fishing, destructive fishing practices and IUU fishing on marine biodiversity and habitats; and (ii) elements of policy and management aiming at the mitigation, reduction and, where possible, elimination of the impacts of fisheries on biodiversity and habitats.

This report provides an overview of key conclusions and related action points for management regarding the impacts of overfishing, destructive fishing and IUU fishing on marine biodiversity and habitats.

CONTENTS

1. DEFINITIONS

The following definitions indicate the understanding of the expert group. They are general in nature and in order to operationalize them, they need to be considered in the context of a specific fishery, ecosystem, management framework, etc.

1.1 Unsustainable fishing

The term "unsustainable fishing" describes: (i) a situation (in contradiction with the Law of the Sea Convention) characterized by overfishing or inadequate fishing pattern; (ii) fishing activities that lead to long-term losses in the biological and economic productivity, biological diversity, or impacting ecosystem structure in a way that impairs functioning of the exploited system across several generations.

For the purpose of this report, and following the CBD requirements, unsustainable fishing will be decomposed in partly interconnected components as follows: (i) Overfishing; (ii) Destructive fishing; and (iii) IUU fishing. It is recognized that extreme forms of overfishing could be destructive and that IUU is an aggravating factor of both overfishing and destructive fishing.

1.2 Overfishing

The term covers three interconnected phenomena: biological overfishing, economic overfishing and ecosystem overfishing. Biological overfishing of whatever exploited species (target or non-target) is defined as a situation in which the fishing pressure exerted on the species is higher than the pressure theoretically required for harvesting the maximum sustainable yield (MSY), or would, if continued in the medium term, impair the population productivity. Economic overfishing occurs when a fishery is generating a rent lower than the maximum rent obtainable (e.g. below maximum economic yield [MEY]), primarily because an excessive level of fishing effort was applied. Ecosystem overfishing is defined as the situation in which the long-term historical species balance (i.e. species composition, dominance, and their natural oscillations) have been significantly modified by fishing – e.g. the reductions of fish predators can lead to increases of small and short-lived species at lower trophic levels.

1.3 Destructive fishing practices

The term refers to the use of fishing gears in ways or in places such that one or more key components of an ecosystem are obliterated, devastated or ceases to be able to provide essential ecosystem functions. From an ecosystem and precautionary approach perspective, destructive fishing refers to the use of gears and/or practices that present a high risk of local or global damage to a population of target, associated or dependent species or their habitat, to the point of eliminating their capacity to continue producing the expected goods and services for present and future generations, particularly if recovery is not possible within an acceptable time frame. Few, if any, fisheries are consistently "destructive". Only a very small number of fishing gears or fishing methods are recognized as inherently "destructive" wherever and however they are used, the primary examples being explosives and synthetic toxins.

In the absence of any formal agreement regarding the term, the classification of a gear or practice as destructive is a policy choice related to pre-set objectives and consistent with national and international law.

1.4 Illegal, unreported and unregulated (IUU) fishing

IUU fishing is defined in the International Plan of Action to Prevent, Deter and Eliminate Illegal Unreported Unregulated Fishing as follows:

Illegal fishing refers to: the following fishing activities: (i) those conducted by national or foreign vessels in waters under the jurisdiction of a State, without the permission of that State, or in contravention with its law and regulations; (ii) those conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organization, but operate in contravention of the conservation and management measures adopted by that organization; or (iii) those conducted in violation of national laws or international obligations, including those undertaken by cooperating States to a relevant regional fisheries management organization (RFMOs).

Unreported fishing refers to: (i) fishing activities which have not been reported, or have been misreported to the relevant national authority, and in contravention of national laws and regulations; or (ii) fishing activities

undertaken in the area of competence of RFMO, which have not been reported, or have been misreported, and in contravention of the reporting procedures of that organization.

Unregulated fishing refers to: (i) fishing activities in the area of application of a relevant RFMO, that are conducted by vessels without nationality, or by vessels flying the flag of a State not party to that organization, or by vessels in a manner that are not consistent with or contravenes the conservation and management measures of that organization; or (ii) fishing activities in areas, or for fish stocks in relation to which there are no applicable conservation or management measures, and where such fishing activities are conducted in a manner inconsistent with States' responsibilities for the conservation of living marine resources under international law.

2. OVERFISHING

2.1 Key conclusions on impacts

The detrimental ecosystem effects of overfishing can be direct or indirect.

Direct effects are those that result directly from excessive fishing activities such as excessive mortalities of target or non-target species.

Indirect effects emerge as a feed-back or feed-forward delayed response of the fishery system such as changes in the species assemblages arising from: (i) thinning or elimination of prey populations (bottom-up forcing); (ii) excessive reduction of predators (top-down effect); and (iii) altering the size composition or the life history traits of the resource. Further, species important to system function may be affected by overfishing such as excessive removals of herbivores can lead to habitat modification.

These effects tend to become more acute with the increase in fishing pressure. Phenomena connected to (and susceptible to increase) overfishing include: unreported bycatch and discards, ghost fishing and IUU fishing which are sources of underestimation of the fishing pressure and hence a potential contributing or aggravating factor of overfishing.

The impacts of overfishing on marine species diversity can be expressed in the following forms: (i) the modification of community structure (e.g. trophic structure); (ii) the reduction in species richness or other taxonomic diversity indices; and (iii) risk of local extinction (i.e. severe reduction of the impacted populations to the extent that they become threatened, endangered, or even locally extinct).

The world situation of fisheries and of the ecosystems they use is not satisfactory and provides the context for a discussion of fishing policies and practices that, directly or indirectly have led to a high degree of unsustainability of the sector at global level, with some highly instructive exceptions.

The paradox is that fishers cannot exist without a healthy resource system and the fishery sector is of high importance for the livelihood of a large community of users highly dependant on fishing and for the food security of some 200 million people, especially in the developing world, where one in five people are dependent on fish as their primary source of protein.

The sustainability of seafood supplies is a major concern of FAO which estimates that almost 28 percent of exploited stocks are overexploited, depleted or recovering. Approximately 95 percent of the world's marine production depends directly or indirectly on the productivity of coastal ecosystems and shallow continental shelves.

Obviously, for many areas, fisheries are a major stressing factor on marine ecosystems and the problems relate to weak governance, excessive fishing capacity and inappropriate gears and practices.

Some fishing gears are known to be more selective than others but no fishing gear is perfectly selective in relation to the targeted species/sizes. As a consequence, it is inevitable that unwanted species and sizes of fish will be captured.

Discarding practices have been estimated to lead to 7 million tonnes of fish being rejected dead at sea. While apparently in clear decline, the phenomenon still creates concern.

Most fishery management systems do not include mandatory reporting of discards. The biodiversity implications are that the diversity and quantity of species caught are not accurately known, affecting stock, environmental impact, and risk assessments. Improved selectivity of gears and practices is a way to reduce

discards. It must be noted, however, that the final ecosystem impact of selectively harvesting and protecting species is not yet completely understood and needs to be assessed when measures are proposed.

It is important to realize that, despite their conspicuous imperfections, fisheries are still the most ecologically-compatible system of meat production, in terms of ecological footprint as well as energy consumption per tonne of meat produced. Terrestrial biodiversity would be severely impacted if the 190 million tonnes of fish that, according to FAO (in SOFIA 2002), will be needed by 2030 (of which 85 percent directly for human food) were to be replaced by terrestrial meat production.

Estuaries, salt marshes, shallow bays and wetlands, mangroves, coral reefs and seagrass beds are also habitats or spawning/rearing areas for species later caught further offshore. Together with inland waters, coastal ecosystems are also the most affected by nutrient and pollution runoff from land. This has a probably important and yet un-assessed impact on fisheries productivity and fish quality. In addition, many fishing impacts on aquatic systems are indeed exacerbated by an often irreversible environmental degradation.

2.2 Action points for policy and management

Ecosystem overfishing is irresponsible according to the FAO Code of Conduct. In terms of impacts on marine biodiversity and habitats, excessive or sustained overfishing depletes targeted population, changes the dynamics of the impacted ecosystems, modifies life history traits, some of which may have a genetic component, and modifies the used habitats, beyond the limits imposed by society (e.g. in compliance with the concepts of sustainable use and responsible fisheries).

It should be stressed that, in so doing, ecosystem overfishing also threatens the social and economic viability of fishing communities, their livelihoods, and food security, both locally and globally. Directed fishing on specific stocks may increase the biological or economic outputs of the ecosystem and societies may choose to permit such changes. However, this would likely lead to loss of biodiversity.

Even if major changes to an ecosystem caused by excessive or sustained overfishing have increased overall productivity or have enhanced an ecosystem service that society values, there has been a loss of biodiversity in achieving that outcome. These costs need to be part of the planning and debate of policy and management.

Many of the concepts in policy and management measures discussed below are complex, and there are major differences between small-scale and large-scale fisheries that affect many of the considerations below. FAO has developed guidelines on practice and implementation for the precautionary approach, ecosystem approach and many other such terms and concepts. All that guidance should be taken into account when considering these terms and concepts in the context of conservation of biodiversity.

2.2.1 Drivers and constraints

The key drivers of overfishing stem from open access to fish resources, either in the form of the western tradition of freedom of the seas, or for much of the world loss of traditional community control. The phenomenon is fuelled by human quest for food and livelihood and the related economic and social forces. It is accelerated by demography (and related food demands), short-term economic profits and inadequate governance. The consequence is the heavy overcapitalization and/or excess fishing capacity existing in most countries, often supported by subsidies and inappropriate incentives and management measures.

Major factors that constrain the fight against overfishing include: (i) the lack of alternative livelihoods, particularly in rural areas; (ii) the lack of allocation of rights appropriate to the social and economic context of the fishery; (iii) inadequate governance, particularly lack of institutional cooperation and, coordination, both between fisheries and environmental agencies and across industry sectors; (iv) conflicting objectives, differences in risk tolerances, and differing expectations of the diverse groups of stakeholders; (v) the insufficient capacity in management institutions, and particularly for monitoring, control and surveillance; (vi) the incomplete knowledge about the resources and their ecosystems; and (vii) the difficulty to carry out traditional experiments with proper replication, in real-world fisheries. The latter constraint is particularly acute in relation to the implementation of the ecosystem approach to fisheries.

Not all the drivers and constraints will apply to any single fishery or set of fisheries. An evaluation of the biodiversity concerns associated with any particular fishery, relative to the social and economic context of the fishery, is necessary, as a basis for incorporating biodiversity in fisheries management.

2.2.2 Instruments and measures

2.2.2.1 International and regional instruments

The overarching principles for sustainable fisheries have been agreed and are enshrined in a number of international fishery instruments adopted for oceans governance, including the 1982 UN Law of the Sea Convention (LOSC); the 1993 FAO Compliance Agreement, the 1995 UN Fish Stock Agreement and the 1995 FAO Code of Conduct for Responsible fisheries. With their accompanying guidelines and action plans, they represent a comprehensive framework for fisheries policy and management and have been translated in fisheries legislation in most fishing nations. If these instruments were fully and effectively implemented then sustainability and conservation of biodiversity would largely be achieved.

Other instruments have been adopted to deal specifically with biodiversity and conservation, but have strong implications for fisheries:

1. The 1948 IUCN Red List of Endangered Species Assessment aims at providing a comprehensive, scientific, and rigorous examination of conservation status of species. Few marine species are presently assessed under the Red List but efforts are being made to fill the gap, particularly for key commercial species or particularly vulnerable species groups. The Red List process specifically identifies species or populations whose viability may be threatened directly or indirectly by fisheries, and where the need for conservation measures is particularly urgent.
2. The 1992 Convention on Biological Diversity (CBD), aiming at conservation and sustainable use of biodiversity, and fair and equitable sharing of benefits arising from its genetic resources. Of particular relevance to marine fisheries, the conservation measures outlined in CBD include protected areas, regulation and management of biological resources, protection, rehabilitation, and restoration of degraded ecosystems and habitats. Under the framework of the Jakarta Mandate the Programme of Work on Marine and Coastal Biodiversity as well as the Programme of Work on Protected Areas provide a basis for implementing various measures for addressing the conservation needs, based on the ecosystem approach and the precautionary approach. Many actions arising form these Programmes of Work will have direct implications for sustainable use, and must be harmonized with fisheries management measures,
3. The 1975 Convention on International Trade in Endangered Species (CITES), aiming at protecting species that are clearly threatened by international trade. The trade of these species is governed by different sets of obligations depending on the severity of the threat and the type of appendix (I, II or III) in which the species is listed. A memorandum has been signed between FAO and CITES which collaborate towards adapting CITES criteria to fishery species. Under the Memorandum of Understanding (MoU), an independent international Panel has been established in FAO to advise the CITES Secretariat on the listing proposals.
4. The Global Plan of Action for the Protection of the Marine Environment from Land Based Activities, established in 1995, has made substantial progress in addressing 6 of its 9 source categories (such as persistent organic pollutants [POPs]). The remaining categories where progress is needed include wastewater nutrients and the physical alteration and destruction of habitats and all have direct relevance to fisheries and biodiversity.
5. Regional Seas Conventions and associated Action Plans throughout the world's oceans provide protocols for dealing with issues directly related to fisheries and biodiversity including specially protected areas, integrated coastal management, and pollutants such as POPs.
6. The International Convention for the Prevention of Pollution from Ships (MARPOL) deals with the prevention of pollution by garbage from ships. MARPOL Annex V completely prohibits discharge of synthetic fishing nets. However, the regulation does not apply to the accidental loss of synthetic fishing nets, provided that all reasonable precautions have been taken to prevent such loss.

Although there are many fisheries instruments at global and regional scales, their implementation has been incomplete and sometimes produces mixed results. There is a need to examine reasons why full success has not been achieved. There is also a need for evaluation of the FAO Technical Guidelines for the Precautionary Approach and the Ecosystem Approach to Fisheries in relation to biodiversity conservation. Building on these examinations, each environmental instrument should be reviewed in terms of the role it

can play in filling policy gaps where they occur, and for addressing implementation gaps in the fisheries instruments.

2.2.2.2 Plans and measures

The translation of principles and instruments into national policies, legislation and measures has been going on actively at global, regional and national levels. Guidelines have been made available and new protocols are being tested (e.g. regarding EAF). The main policy orientations and plans to rationalize fisheries and effectively rebuild overfished and depleted stocks have been developed at the FAO Committee on Fisheries (COFI) with significant interaction with the UN General Assembly. Only a few of the possible measures are examined briefly below in terms of their relevance to biodiversity conservation and sustainable use.

EAF management planning

Fisheries governance must be modernized, adopting formally and implementing effectively the ecosystem approach to fisheries (and the precautionary approach to fisheries), adaptive management processes, participative decision-making and implementation. For all fisheries, formal management plans (particularly EAF-based plans) should be adopted. For severely depleted stocks, moratoria should be considered and specific rebuilding plans must be developed. The EAF Process is the place where the harmonization of fisheries and biodiversity objectives must be achieved. The EAF process then allows the major biodiversity issues associated with a fishery to be identified, as a basis for the selection of tools to address them.

Matching of capacity to resource and ecosystem productivity

It has been a pre-eminent priority of sustainable fisheries to remove excess capacity and harmful subsidies, and to allocate individual or communal user rights in a manner that is appropriate for the social and economic context of the fishery. In fisheries where persistent overfishing occurs, these actions are usually necessary before there is reason to expect significant benefits from any of the other measures. Improving fisheries sustainability through managing capacity and allocation of rights will reduce the risk and/or magnitude of overfishing. To the degree that this succeeds, the risks and/or magnitude of the detrimental impacts of overfishing on biodiversity (2.1) are also reduced, although benefits are not targeted at individual biodiversity concerns.

Optimization of fishing regimes and minimization of environmental impact

This class of measures aims, *inter alia*, at addressing concerns related to selectivity, by-catch, discards and environmental impact. It includes: (i) area-based management measures (e.g. marine protected areas); (ii) disincentives to discarding (see Table 1); (iii) the development of new and improved fishing gears and fishing practices (e.g. rotational harvest, closed areas and seasons, Table 1). These measures can be specifically targeted at any specific biodiversity concern, and should be part of any dialogue on fisheries management. They are actually directed at the issues identified in the EAF process.

Marine protected areas (MPAs)

The development of marine areas networks requested by the 2002 World Summit on Sustainable Development (WSSD) for biodiversity conservation might include marine protected areas (MPAs) specifically designed for fisheries management with stakeholders' participation, within EAF. MPAs designed for fisheries management need to be looked at in combination with the other management measures for the fishery, to ensure the suite of measures work together to achieve their fishery objectives. In addition, when designing MPAs and other spatially based management tools for fisheries management objectives, it is desirable to ensure that the EAF process has successfully harmonized the fishery and biodiversity objectives, so the MPAs can be designed and managed to contribute to both classes of objectives. Where MPAs have been created to address biodiversity objectives, fisheries planning should take these MPAs into account in their planning process.

Market instruments

In some places market measures have been used to increase the role of consumers in fisheries governance: particularly certification schemes and sustainable seafood campaigns. The first are driven essentially by the private sector (sometimes with direct involvement of non-governmental organizations [NGOs] like in the Marine Stewardship Council, [MSC] and involve formal and controlled labelling. They aim at assuring the consumers that the fish and fishery products offered have been sustainably produced. It is possible to build specific biodiversity considerations into these instruments and target specific biodiversity objectives, such as the several components of Principle 2 of the MSC certification standards. However, market instruments cannot be assumed to provide biodiversity benefits unless they have been intentionally built into the specific application of a market instrument. Market instruments have potential to contribute to biodiversity concerns in many ways but their real end impacts on fishery and biodiversity outcomes are still being assessed.

Table 1 provides an overview of existing instruments and possible management measures with their relevance in relation to addressing overfishing, destructive fishing practices and IUU fishing.

Social and economic measures

In fisheries, the implementation of a range of social and economic measures and incentives, in addition to conventional measures, have proven to be very effective in fighting overcapacity and overfishing. Fishing rights improve behaviour by providing a sense of long term security in entitlements and an incentive to optimize production in the short and long term. A higher degree of participation in the decision-making process (including possibly the devolution of some management authority) can increase the legitimacy and relevance of the measures and, possibly, compliance. There is reason to believe that the same sort of strategies would also be useful to ensure conservation and sustainable use of biodiversity. Economic incentives, for instance, might be very effective in some cases, e.g. linking the granting of opportunities to fish to reducing catch of vulnerable or endangered species. However, a number of uncertainties exist. For example, there is not much experience in testing user rights in a multiresources, multi-user environment such as a costal area and experiments are needed.

Strengthening of regional fisheries management organizations (RFMOs)

In order to reduce the impact of overfishing on marine biodiversity regional fisheries management organizations/arrangements (RFMO/As) should be strengthened. Regional fisheries management organizations/arrangements have a central role to play in coordinating States efforts and establishing multilateral measures. They should: (i) take measures to control overfishing; (ii) increase collaboration with other mechanisms or organizations to address biodiversity concerns; and (iii) be developed in areas currently not covered.

Filling information gaps

Information on the essential characteristics of fisheries (effort maps, habitat maps, etc.) is often inadequate or not available. New observational technologies provide a detailed habitat characteristics and ecosystem structure and function which can complement information from research vessel surveys and analysis of commercial fisheries data. Improved collaboration between environmental and fisheries institutes could provide the information needed particularly to promote spatial considerations; the concept of underwater landscapes and of habitats continuity; the conservation of structural features in the habitat; the importance of scales in habitat characterization and rehabilitation; etc.

3. DESTRUCTIVE FISHING PRACTICES

3.1 Key conclusions on impacts

All fishing activities have some impact and these have been well described in the literature. They may include: reduction of the target and non-target populations' abundance and spawning biomass; modification or destruction of the habitat; modification of the food chain; modification of the phenotypes (e.g. size/age at reproduction, growth parameters) and possibly genotypes; changes in species dominance (e.g. increase of small prey species and decrease of top predators); and, in contaminated areas, recirculation of pollutants and aggravation of anoxia. However, these effects may largely be controlled by management and, if of limited extent and reversible, do not qualify as "destructive".

Some of these modifications have been shown to be favourable to the target species as its food preys increase and their competitors are eliminated (e.g. in the case of flatfish in the North Sea or Hake in West Africa and the Mediterranean) leading to a sort of "extensive farming" at the expense of the original diversity.

The impacts of destructive fishing practices can be direct and indirect as for overfishing and for the same reasons. Both direct and indirect impacts may be cumulative and their seriousness increases with their extension in space and time:

1. Direct/immediate effects are generally easily and rapidly detected such as local habitats destruction. Bottom trawling and dredging on benthic environments and communities with well-developed epifauna (such as seagrass, algal or bryozoan beds; tropical coral reefs, cold water corals; and sponge reefs) will be directly destructive when the structural complexity of the original habitat is removed and cannot replace itself in biologically appropriate timeframes. Biological timeframes must include recovery time of the feature itself and the time to recover its function in the ecosystem.
2. Indirect/delayed effects emerge as delayed response of the fishery system as the impact is transferred through the ecosystem to its point of emergence or as it accumulates to the point that it becomes visible. Endangering larval or juveniles' survival by: (i) damaging their living habitat; (ii) releasing fatal contaminants trapped in the sediments; (iii) increasing natural mortality by reducing structural protection in complex habitats (e.g. removing large boulders or crushing corals) is an example.

Impacts of destructive fishing – as all impacts on a natural ecosystem – have time and space dimensions:

1. In terms of time scale, it is useful to distinguish between immediate (usually direct) and delayed (likely indirect) impacts of destructive fishing. The first may result, for example, from physical damage to the habitat. The second may result from: (i) the transfer (and amplification) through the food chain or the ecosystem or (ii) the progressive accumulation or aggravation of an impact, e.g. through persistent or excessive fishing activity.
2. In terms of space scale, the impact of fishing could be locally destructive but still sustainable at the ecosystem level.

While potentially "destructive" impacts on the target populations have usually been dealt with mainly within the concept of "collapse" or, more rarely, "extinction", the term "destructive fishing" has been mostly used to refer to impact considered as severe or unacceptable on the broader environment of target populations and on the ecosystem.

Extinction (or a high risk of extinction) of the resource and/or the productive ecosystem and its biodiversity is a potential outcome of destructive fishing. Good fisheries management should have detected the potential causes long before possible extinction has become an issue. However, any time a species is evaluated as being at risk of extinction a high degree of precaution is required.

Serious overfishing may lead to destructive practices. Increasing fishing pressure beyond the level that can be tolerated by the system, for a protracted period of time, carries the risk to reach destructive levels of fishing. Measures to counteract overfishing should already have been taken by management before it has reached this level.

Unaccounted mortality has become a subject of concern. ICES identified unaccounted mortalities related to: (i) misreporting; (ii) discarding, if the related deaths are not accounted for; (iii) escaping, e.g. encountering the gear but not being retained by it; (iv) dropping out during hauling; (v) ghost fishing; (vi) avoidance behaviour; (vii) habitat degradation; (viii) increased predation; and (ix) infections and diseases. These sources of mortality should be accounted for in the stock assessment and in the development of fisheries management plans.

Studies of gear impacts suggest substantial differences in impacts on habitat can occur. Particularly vulnerable habitats include:

1. Habitats subject to very little natural disturbances e.g. by tides or storms, such as deep muddy grounds or seamounts or hot vents that can offer biologically-complex habitats are less resilient and may require longer recovery times than, say, sand dunes or battered coastal reefs.
2. Hard bottoms hosting fragile bio-structures such as hard corals (gorgonians and scleractinians), sea pens, and some large sponges used as habitats by a high diversity of life forms, may be severely affected by even moderate exposure to bottom gears;

In addition some populations and ecosystems could be particularly vulnerable:

Endemic island ecosystems where any local extinction is global by definition. Seamounts are a particular example of this case even though the degree of endemism is still being investigated.

Source-sink populations which depend for their reproduction on imports from elsewhere (e.g. lobsters and conchs) due to the absence of suitable spawning areas or complex life cycles. They heavily depend on prevailing currents and can be driven to extinction by overfishing their "source" of offspring.

Populations with particularly vulnerable life histories.

3.2 Action points for policy and management

Any fishing activity qualifying for the adjective of "destructive" is incompatible with sustainable use and breaches all international instruments and agreements based on the UN LOSC, including the CBD. It is therefore States' responsibility to limit the risk of destructive use to the minimum.

3.2.1 Drivers and constraints

Both the drivers and constraints relative to destructive fishing practices are similar to those of overfishing. Many factors which are causes of overfishing become causes of destructive fishing practices when they occur at excessively high levels or persist over longer times. Failure to effectively address the constraints encountered when dealing with overfishing and biodiversity conservation often increases the risk that the unsustainable practices will become destructive. Furthermore, some of these constraints are even more difficult to overcome when fishing practices have become destructive.

3.2.2 Instruments and measures

3.2.2.1 International and regional instruments

The legal instruments available are the same as under section 2. All of these instruments contain obligations and commitments to fight against the negative impacts of fishing on marine organisms and therefore, a fortiori, against destructive fishing.

However, in the case of destructive fishing practices, the biodiversity instruments may have to be given greater priority than the applicable fishery regulations in order to ensure ecosystem impacts are sustainable. As a consequence it may be necessary for fisheries managers to adapt the application of traditional fisheries instruments to accommodate the biodiversity instruments fully.

3.2.2.2 Plans and measures

Reduction of fishing capacity

Reducing fishing capacity will have all the benefits discussed in the corresponding part of Section 2. To the extent that the biodiversity concern has arisen because the intensity of a fishery practice has reached a level that is destructive, reducing capacity and effort will reduce the destructiveness of the practice, and if reduced enough the practice may cease to be destructive. However, in some cases the biodiversity concern may be a highly localized ecosystem feature, such as rare habitat or rare and highly vulnerable species. In those cases even large reductions in capacity may not address the destructiveness of the practice effectively, unless additional measures are added to target the remaining fishing effort away from the biodiversity feature of concern. However, even when reduction in effort alone may not be adequate to eliminate the destructive consequences of a fishing practice, the reduction in capacity may be a precondition for other measures to be implemented effectively.

Risk assessment and management

Assessing and managing risk requires its mapping. Where information exists, ecosystem features potentially damaged should be mapped and these maps should be used in environmental risk assessment (ERA). The 2008 FAO criteria for vulnerable marine ecosystems (VME) and the 2008 CBD scientific criteria for ecologically and biologically significant areas (EBSAs) will provide useful guidance.

Environmental impact assessment

Environmental impact assessment (EIA) should be conducted in line with the United Nations General Assembly (UNGA) Resolution 61\105 and the FAO International Guidelines of the management of deep-sea fisheries in the high seas and relevant national regulations. Adopting qualitative and/or quantitative environmental risk assessment as part of the EAF allows for early identification of the major risks of destructive fishing practices relative target species or biodiversity, and the development of strategies to avoid or mitigate the risks before the fishery is allowed to proceed.

Monitoring

Improved monitoring is necessary to ensure compliance or manage risk where conservation measures are in place to prevent destructive fishing practices, or where the risk of practices being destructive varies greatly in space or time. When the ecosystem features potentially at risk of destructive impacts are spatially located, then remote systems like vessel monitoring system (VMS), may be effective, if connected to monitoring, control and surveillance (MCS) capability, and accompanied by deterrent penalties in case of non compliance. However some biodiversity properties of particular concern may not be effectively protected by solely spatial management, and in those cases on-board or at-site observation systems may be necessary.

Capacity-building

Insufficient implementation capacity is a serious issue in many coastal tropical and sub tropical fisheries characterized by high species diversity. Fishery authorities in these regions, especially those in developing countries, often lack the resources to effectively monitor fleet activity and report multispecies catches, which makes it particularly challenging to incorporate biodiversity considerations into fisheries management.

Selectivity

Improving selectivity has been a central concern of fishery management for decades. The issues relate to gear performance, fishing operations and monitoring. If gear performance can be adapted to reduce the catch of species of concern, then the related measures can mitigate the effect of fishing on biodiversity. Selectivity of fishing operations can also be improved by controlling when, where or how a fishery is allowed to operate. In order to be effective, more selective gear and operations must be carefully designed, thoroughly tested and implemented as intended in the fishery. In both cases, monitoring is also important. As noted under assessing and managing risk, on-board observers are necessary if the consequences of efforts to improve the selectivity of fishing gears or practices are to be monitored. When observers are present, additional measures to address potential destructiveness of fishing practices become available, such as flexible, real time closures of areas triggered by detection of the presence of vulnerable species or habitat features.

Protecting vulnerable habitat

Vulnerable habitats are those that can easily be damaged by a fishing activity, with detrimental consequences for biodiversity. As such, habitats vulnerability is specific to particular fishing practices. Some habitats may be vulnerable not because of their physical features but because of their ecological functions, such as migration corridors or spawning grounds.

Banning specific gear practices:

The deployment of mobile, bottom-contacting gears like trawls ands dredges on highly vulnerable habitats should be prohibited, unless mitigation measures known to be effective in reducing habitat impacts are in place. Particularly destructive techniques such as blast fishing are already universally banned but enforcement is not always adequate. Reducing poverty might be necessary in many places, in order to create the conditions where these particularly destructive techniques are abandoned by fishers. However, the instruments are not in the fishery sector.

Closed areas including MPAs

Because habitats are inherently spatial, closed areas and MPAs are likely to be effective in protecting vulnerable habitats from specific fishing practices, if they are appropriately situated and properly managed. When direct enforcement capacity may be weak, the placing of “sleeping policemen” or ”anti-trawling reefs” in near-shore vegetated areas with an accompanying warning to fishing vessels, is one way of discouraging mobile gears in shallow water closures.

Rotating harvest schemes

Rotational harvest schemes can protect vulnerable habitats when the rotation schedule is longer than the recovery time of the habitat.

Gear substitution

Gear substitution can be an effective measure to protect vulnerable habitats from destructive fishing practices, if the fishing practice being implemented has a much lower impact on the vulnerable habitat. However the full range of potential consequences of the proposed gear substitution should be evaluated ecologically and socio-economically, to understand the possible costs and benefits of the change before it is implemented. A number of factors currently limit the opportunity to substitute a destructive fishing gear with a cost effective alternative. This includes existence of allocation agreements, resistance to change, lack of economic incentives, compatibility of vessel and fishing gear, and operator experience. Using an alternative fishing gear may also affect the safety of the vessel and crew.

Modifying or deploying a gear in a less harmful manner

Some gears may be deployed in ways that reduce their interaction with vulnerable habitats. Such modification of practice can also be effective in reducing habitat damage, but as with gear substitution, the full range of potential consequences of the proposed gear substitution should be evaluated ecologically and socio-economically, to understand the possible costs and benefits of the change before it is implemented.

Reducing ghost fishing

A number of measures can be taken to reduce ghost fishing: (i) gear retrieval programmes may be set up for recovery of lost or abandoned gear in case these are significant. This is already the case in some countries (e.g. Norway, United States of America). The removal of the gear eliminates the threat that gear may pose to biodiversity; (ii) marking of fishing gear programmes will contribute to reducing detrimental impacts of ghost fishing on biodiversity only when there are programs to retrieve lost gear and the capacity to inflict penalties on fishers for the loss of gear; (iii) using biodegradable material for fishing gears that may be lost can contribute to reducing the impacts of ghost fishing on biodiversity whenever such materials will render lost or abandoned gear ineffective at catching or retaining species. Further development and testing of gears using biodegradable materials is needed; (iv) zoning could be a solution when interactions between gears are a significant factor in gear loss. For example, a clear separation of trawling and netting activities would reduce gear conflict and net loss; and (v) effective implementation of MARPOL Annex V would reduce the number of abandoned, lost or otherwise discarded fishing gears in the world's oceans.

Protecting vulnerable species

Species or populations are considered vulnerable when either their life histories make them inherently able to sustain only a low level of mortality (low fecundity, late age of maturation, etc.) or if they have behaviours which expose a large portion of the population to threats from a fisheries practice (for example, dense spawning aggregations or migration bottlenecks) or other threat. The measures that reduce the threat include the reduction of the fishing pressure and area closures.

When a species is vulnerable because of its life history, it is particularly important that fishing mortality on the population be kept very low, and that there is adequate MCS to ensure that the low mortality is achieved and maintained. Any of the tools discussed under overfishing might contribute to achieving the necessarily low mortality rate, depending on the species and fishery. What differs in the case of vulnerable species is the urgency of achieving the low mortality rate and the potential ecological costs of errors. When vulnerable species have suffered substantial reduction or depletion, the IUCN Red List and CITES listings provide additional moral and legal weight to efforts to keep mortality low. Responsible fisheries management should have intervened to reduce fishing mortality before these instruments apply, but in highly vulnerable species their added weight in implementation may be important.

For species vulnerable because of their behaviour, the spatial tools used for habitat protection can be effective in protecting the species or population under the conditions of high vulnerability. As mentioned in reference to measures to improve selectivity in section 3.2.2.2, in order to be effective, the measures must be carefully designed, thoroughly tested and implemented as intended in the fishery.

Table 2 provides examples of possible gear impacts and of related mitigation measures.

Social and economic measures

The points about social and economic incentives and measures made with regard to overfishing generally apply to destructive fishing practices as well. However there are some additional complexity in the design and application of these tools, if they are intended to address destructive fishing practices.

Education in marine conservation and resource stewardship, through courses and other means of awareness raising may assist in making coastal communities more aware of the dangers of destructive fishing, and the benefits of marine biodiversity, and in informing participants in fisheries about effective ways to voluntarily reduce impact on vulnerable species and habitats. Sustainable livelihoods programmes have an important role to play in addressing destructive fishing, particularly in small-scale fisheries.

Control of access and allocation of fishing rights may reduce many of the risks associated with the race for fish, and some of these factors are often the driver that makes fishing practice become destructive. As such access and user rights can contribute to reducing the risk of destructive fishing practices. However when the destructiveness of a fishing practice is because of a highly vulnerable species or habitat, allocation of rights alone may not address the biodiversity concern. In cases it may be possible to allocate directly rights to the biodiversity feature of concern, but this strategy is largely unproven and would require highly effective MCS.

The material in section 2.2.2.2 on the role of market instruments in addressing overfishing is generally relevant to addressing destructive fishing practices as well. Where these instruments are effective, they can be particularly valuable in addressing destructive fishing, by making effective reduction or elimination of the destructiveness of a fishing practice a necessary condition for obtaining the market advantages.

Strengthening of RFMOs

Again the material in 2.2 on strengthening RFMOs is generally applicable to addressing destructive fishing practices. RFMOs are the only vehicle by which fisheries managers may deal with destructive practices beyond national jurisdiction. As such there is a need to build closer coordination of RFMOs with regional environmental agencies, such that the priorities and measures of both types of agencies can be harmonized. These agencies will also need to be strengthened to participate in monitoring, identification of risks and threats, and evaluation of impacts. If strengthened, the environmental agencies have valuable roles to play in quantifying impacts of other industries on the species and habitats of greatest concern, and to coordinate conservation measures broadly across industry sectors.

New observation technologies

Fisheries assessment work continues to rely heavily on research vessel surveys and the analysis of commercial fisheries data. Over the last several decades however, direct observational methods involving underwater photography, scuba and sidescan sonar, have provided more and much details on habitat characteristics and ecosystem structure and function. As indicated in section 2.2.2.2, a better collaboration between environmental and fisheries institutes could provide the information needed particularly to promote spatial considerations; the concept of underwater landscapes and of habitats continuity; the conservation of structural features in the habitat; the importance of scales in habitat characterization and rehabilitation; etc.

Gear technology research

Observation of fish reaction to gears has promoted development of devices and practices to improve both species and size selectivity. Assessment of survival after gear encounter has allowed this source of mortality to be accounted in stock assessment process. Research on fish behaviour and fish reaction to gears, including survival after gear encounter should be extended to a much wider range of species, gears and fisheries and coupled with promotion and awareness raising within the fishing community would accelerate the process of transition to more environmentally friendly fishing gears and practices.

Coordinated scientific advice

As noted above, fisheries agencies and environmental agencies will often have to cooperate in the identification of risks of destructive fishing practices and development of appropriate mitigation strategies. Implementation of necessary conservation actions across diverse fisheries and industry sectors will often also be necessary to address the biodiversity consequences of destructive fishing practices. Such cooperation and coordination can best be built if the agencies all receive science advice that is fully coordinated as well. Such advice is best produced by a single science advisory process, including an adequately broad range of

experts from the full spectrum of professional perspectives. Integrated assessments will often be a key part of such science support.

Integrated management plans

Marine ecosystems, biodiversity and habitats are affected by several human activities (as fishing, oil and gas exploration, shipping, tourism, etc.). For a holistic approach to the use and conservation of marine ecosystems, integrated management plans should be developed as a basis for political decisions and corresponding legislation and management measures.

4. ILLEGAL, UNREPORTED AND UNREGULATED (IUU) FISHING

4.1 Key conclusions on impacts

Because of its broad, encompassing nature, IUU fishing is a worldwide phenomenon that occurs both in exclusive economic zones (EEZs) and the high seas, and in many types of fisheries, of small or industrial scale. The only study done at a global scale estimated IUU catches to about 11-26 million tonnes, representing about 13-31 percent of reported landings in the 1990s and a loss in landed value of 10-23.5 billion of US dollars annually.

Clear, simple definitions of exactly what is and is not IUU fishing have proven elusive. For example, small scale fisheries may not be reported or regulated in the sense of large scale fisheries but they are not usually considered as IUU fisheries. In this section we will focus on the contribution of IUU fishing to issues of biodiversity conservation. These concerns are not likely to depend greatly on definitional details of what is or is not IUU fishing, although as with all forms of fishing, the particular biodiversity concerns of IUU fishing will depend on what type of IUU fishing is occurring where and when, and at what level.

In the context of biodiversity, IUU fishing is a general concern because it is a major factor in overfishing in many parts of the world. It undermines sustainability of managed fisheries, and adds substantial uncertainty to all aspects of evaluating the status of exploited stocks and ecosystems and effectiveness of management actions. Where IUU fishing is a major factor in unsustainable fishing of target species, it is likely to be a major threat to biodiversity conservation as well. Beyond this general concern IUU fishing has some special factors in the context of biodiversity: (i) IUU fishing is likely to ignore any specific regulations implemented to protect vulnerable species or habitats, or generally to protect biodiversity; (ii) in some cases IUU fishing may be focused on high value species that are also highly vulnerable to fishing, and where risk of extinction may be of greatest concern; and (iii) many of the measures considered effective in addressing biodiversity conservation issues in LRR (legal, reported and regulated) fisheries are unlikely to be as effective, if the fishery has an IUU component.

There is conflicting information and no consensus on whether IUU fishing is increasing or decreasing. However its priority in policy and management actions has increased greatly over the past decade, and States and RFMOs are committed to reducing it. More information is becoming available on its levels and characteristics.

4.2 Action points for policy and management

4.2.1 Drivers and constraints

Although illegal, unreported and unregulated fishing are treated in combination in most policies, the three types of fishing have different drivers and constraints.

The primary political and socio-economic drivers for IUU fishing are the same as those leading to fisheries unsustainability in general. However, the order of importance of these factors is distinct in IUU fishing. The key factors include: (i) high value/demand of fisheries products; (ii) weak national, regional, and international fishery administration and management; (iii) ineffective monitoring, control and surveillance (MCS); and (iv) poverty, lack of alternative livelihoods, and inadequate social legislation. The secondary factors include: (v) ineffective capacity management; (vi) poor fisheries resource status; and (vii) poor data collection and information exchange creating information gaps.

The major constraints and challenges encountered for improving governance systems include: (i) difficulty of detection because of the nature of many IUU fisheries; (ii) lack of cooperation in deterrence at all levels

(iii) cost and inadequacy of adequate MCS resources; (iv) difficulty in the application of penalties severe enough to be an deterrent; and (v) incapacity or unwillingness of some States to meet their regional and international obligations.

4.2.2 Instruments and measures

Illegal, unreported, and unregulated fisheries have different biodiversity effects: Illegal fisheries have potential for direct harm to populations, species and habitats, and undermine the effectiveness of conservation measures for target species and biodiversity. Unreported fisheries result in greater uncertainty of all aspects of fisheries, and consequently greater difficultly in diagnosing biodiversity concerns, and in developing and evaluating the effectiveness of conservation measures. Unregulated fishing results in both problems, particularly undermining the effectiveness of all conservation measures that are being applied

Given the serious ecological and socio-economic impacts from IUU fishing, the international and national activity to deter such activity has been intense, leading to an arsenal of plans and measures. These measures differ in how long they have been available for application, and the degree to which their effectiveness has been tested, but all are considered appropriate for use in fighting IUU fishing.

Global and regional instruments

A number of specific legal instruments have been developed: the binding 1993 FAO Compliance Agreement; the United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (in short the UN Fish Stock Agreement, in force since 2001); and the subsequent efforts to strengthen the role of flag States and port States, including the 2009 Agreement on Port State Measures to Prevent, Deter and Eliminate IUU fishing.

None of these instruments are specifically directed at biodiversity problems associated with IUU fishing, but all empower governments to take actions which can be targeted on specific problems. For effective use of these instruments, fisheries management agencies and environmental agencies need to coordinate many activities: sharing of information at all levels, identification of priority biodiversity issues associated with IUU fishing, selection of methods to address the issues, and application of their respective resources to implement the methods. The IUU network (www.imcsnet.org) established among fisheries MCS agencies can form one basis for facilitating this greater coordination.

In 2001, FAO developed and adopted a voluntary International Plan of Action to Prevent, Deter and Eliminate IUU Fishing (IPOA-IUU). This IPOA identifies responsibilities for all States, flag States, coastal States, port States, States in applying agreed market measures and for RFMOs. Developed as a voluntary instrument within the framework of the FAO Code, the IPOA-IUU aims to improve Monitoring, Control and Surveillance (MCS) and catch reporting systems, statistical systems (against non-reporting or misreporting), as well as develop and implement specific international instruments and strengthen institutions. It also calls on States to ratify and implement the international fisheries instruments.

Within this overall framework there are a number instruments and measures available to fight IUU fishing and a number of ways to improve the effectiveness of each one as briefly indicated below.

National legislation

Improving national legislation requires: (i) a review of national laws, regulations and practices against IUU fishing and updating and implementing them effectively; (ii) identification of national operators or beneficial owners of IUU fishing vessels and IUU fishing entities; (iii) taking measures to ensure nationals do not support or engage in IUU fishing; (iv) discouraging reflagging of vessels to a State that does not meet flag State responsibilities; (v) taking measures consistent with international law against IUU fishing vessels without nationality; (vi) encouraging transparency and increased publicity in actions taken against IUU fishing. National legislation can be used to address all three types of IUU fishing.

Development policies

Fishery development policies need to provide for: (i) control and reduction of overcapacity, a root cause of IUU fishing; and (ii) elimination of subsidies that fuel overcapacity and thus IUU fishing. Fisheries development policies can be used to address all three types of IUU fishing.

Capacity development

Strengthening MCS capacity requires: (i) adoption of VMS technology; (ii) use on-board observers; (iii) elaboration of catch documentation schemes; (iv) training of MCS-related staff; (v) listing IUU fishing vessels; (vi) cooperation with other States, e.g. through RFMOs; (vii) sharing of relevant information; (viii) provision of assistance to developing States in MCS capacity-building. Improved MCS capacity is essential for effective deterrence of illegal fishing, and is useful in fighting unreported and unregulated fishing.

Flag State responsibility

An improved exercise of this responsibility requires flag States to: (i) develop a registry of all fishing vessels; (ii) maintain a record of fishing vessels entitled to fly the national flag; (iii) before registering a vessel under the national flag, ensure that the State can exercise its responsibility; (iv) ensure that the vessel does not engage in IUU fishing; (v) express the intent to exercise such control over the fishing activities of the vessel; (vi) prevent frequent changes of flag States of IUU vessels by requiring the specification of all previous flag States when the State registers a fishing vessel; (vii) require that all chartering arrangements be fully transparent; (viii) authorize vessels only if the owner/operators agree to fish in accordance with specified conditions designed to all the flag State to maintain control over the fishing activities; (ix) take measures to prevent unreported (or misreported) trasnsshipment of fish at sea; (x) ensure that registered vessels should not transship fish from or re-supply vessels that have engaged in IUU fishing; and (xi) prohibit vessels from engaging in transshipment of fish at sea without prior authorization. Enhancing flag State responsibilities can be targeted at any of the three forms of IUU fishing.

Coastal State responsibility

Coastal States need to: (i) ensure that there is enough capacity to patrol national waters before granting access; (ii) grant access only to vessels whose flag State clearly and continuously exercises its responsibility; (iii) elaborate access agreements that require the flag State to penalize its vessels when the terms and conditions of the access are violated and to assist in the coastal State efforts in MCS; (iv) exchange information and data on IUU fishing, e.g. developing and exchanging list of IUU fishing vessels and owners; (v) develop regionally harmonized legislation and regulations; and (vi) delegate and share with neighbouring States relevant enforcement rights, coordinating and providing assistance to improve MCS. Enhancing coastal State responsibilities can be targeted at any of the three forms of IUU fishing.

Port State responsibility

Port States should: (i) deny port access to IUU fishing vessels for refuelling, re-supplying, transshipping and landing; (ii) require authorization to fish, details of fishing trip, and catch record to show that the vessel is not engaged in IUU fishing; enhancing port State responsibilities is particularly effective at deterring illegal fishing, but can contribute to fighting unreported and unregulated fishing as well.

Market-related measures

Countries used as markets by IUU fishing should: (i) prevent fish caught by IUU fishing vessels from being traded or imported into the national territories; (ii) improve the transparency of national markets ensuring the traceability of fish or fish products; (iii) consider the possibility to use catch certification schemes. This is achieved by: (i) multilateral catch documentation schemes (CDS); (ii) chain-of-custody certification (e.g. Marine Stewardship Council); (iii) multilaterally-agreed import and export controls or prohibitions. However these measures tend to be taken mainly on high-value species and should be adopted and implemented in a fair, transparent, and non-discriminatory manner. Their effectiveness largely depends on the cooperation and coordination between nationals and RFMOs.

FAO initiated the development of a global record of fishing vessels, refrigerated transport and supply vessels which will increase traceability of fishing vessels and fisheries products. It may also improve the capacity of market-based mechanism to discourage IUU fishing. Application of market state measures can be targeted at any of the three forms of IUU fishing, and may be the most easily targeted of these measures, when there is a particular biodiversity concern associated with an IUU Fishery.

Regional fishery management organizations (RFMOs)

RFMOs have a central role to play in coordinating States efforts and establishing multilateral measures such as trade restrictions. RFMOs should: (i) be strengthened or developed (in areas currently not covered); (ii) be

given sufficient resources to carry out their functions; (iii) encourage non-members fishing in the area to join the organization; (iv) integrate measures to control IUU fishing into their management strategy and tactics, and monitoring programmes; (v) develop more efficient (prompt and consistent) decision-making procedures; and (vi) increase collaboration with other relevant RFMOs, e.g. to share information on IUU fishing vessels and catches, and with regional environmental organizations. RMFOs can be effective in fighting all three types of IUU fishing, and are particularly important in addressing Illegal fishing because of their compliance regime.

Civil society including non-governmental organizations (NGOs)

Society (including NGOs) has been a positive force in the fight against IUU. They can continue to raise awareness and reach a broad cross-section of citizens, promote participatory surveillance, implement consumer campaigns, and should be encouraged. These measures can be broad based or targeted at any type of priority biodiversity concern. Civil society can marshal its efforts to fight IUU fishing in general. It can also be targeted effectively at particular IUU fisheries or biodiversity issues.

Governance

Better governance of fisheries in EEZs and the high seas would greatly help against IUU fishing. Developing countries and small island countries are therefore more vulnerable to IUU fishing by both national and foreign vessels. Enhancing governance overall can be targeted at any of the three forms of IUU fishing.

National and regional plans of action

The existing international plan of action against IUU fishing (IUU-IPOAs) needs to be translated into national plans of action (NPOA-IUU) and regional plans (RPOAs) as soon as possible but, to this point, progress in different regions has been variable.

5. SPECIAL CONSIDERATIONS

The policy, research and management action considered above rest on a number of notions of particular relevance to policy implementation. Some important ones are examined below.

5.1 Blending biodiversity and traditional fisheries management

Contemporary frameworks for managing fisheries have been strongly influenced by the FAO guidelines for the precautionary approach and ecosystem approach. Both guidance documents incorporate the benefits of structured processes for bringing knowledge – particularly science information – into advice for decision-making. In various combinations, these structured processes include setting of high level and operational objectives, reference points and/or reference directions, targets, limits, control rules, risk assessment and related tools. Many variants of these components exist to address differences in available information, governance processes, fisheries, etc. As implementation of these structured frameworks proceeds, numerous details often prove problematic. Examples of the types of challenges currently being addressed include:

1. Environmental changes affect the productivity of fish stocks and reference values.
2. Multiple forcers, some associated with human activities and often some not, all affecting stock dynamics (particularly in integrated management contexts).
3. Bringing potential climate change impacts into these frameworks.
4. Dealing with data poor situations.

The biodiversity community has taken a generally similar course in the case of the IUCN criteria for evaluating risk of extinction. Their criteria and guidelines for the IUCN Red List also acknowledge the substantial value of using structured frameworks for bringing science informant and advice to settings where policy and management decisions are needed, and where the decisions really have implications for management and society. Building in part on that experience, the use of indicators and reference points is becoming widespread in the biodiversity community.

Biodiversity considerations are already brought into fisheries management as part of the ecosystem approach, but often not using the current processes for structuring the science/knowledge input to the public dialogue. When blending biodiversity considerations more fully into fisheries management there is a need to develop a shared and intercompatible set of indicators and reference values for use by all communities, and an agreed process for how they are to be used in informing the public dialogue on fisheries decision-making.

This, in turn highlights the urgency of establishing suitable fora for these issues to be discussed between fisheries and biodiversity communities at various levels from local to global. More immediately, there remains substantial work to even finalize the background documents prepared for this, and have them elaborated to the right degree of detail.

5.2 Acceptable level of impact

A major challenge in ecosystems and resources management is the judgment on the degree to which an impact is considered acceptable. At the global scale guidance on standards for such judgments is found in the provisions of international agreements that are negotiated and adopted. States and regional jurisdictions then develop legislation and policies to implement these agreements, augmenting them, as appropriate with their societal values.

In the case of fishery target species, the 1982 UNLOSC has enshrined the concept of maximum sustainable yield (MSY) as a target reference value, both in terms of biomass and fishing pressure. This implied that virgin fish populations could be decreased to about half of their size, to their level of maximum biological productivity. This has been modified by the UN Fish Stocks Agreement which uses the MSY level as a maximum limit for development (to be therefore avoided) and as a minimum level for stock rebuilding.

In the case of ecosystems, the Rio Declaration States agreed to prevent serious or irreversible harm to ecosystems. This provides a global standard of acceptable impact of any activity, including fisheries, on ecosystems. To make this standard operational, an obligation is placed on the science advisors to identify what constitutes impacts whose consequences are ecologically serious, and the reversibility of impacts.

5.3 Recovery and reversibility

There has been substantial interest in the concepts of recovery and reversibility of impacts in all ecosystems, marine and terrestrial. In general there is incomplete and often little understanding of the likelihood and nature of recovery of marine systems from substantial perturbations. However, a number of issues and tentative conclusions emerge from most studies of recovery of marine ecosystems or reversibility of specific perturbations:

1. Ecosystems vary greatly in capacity to recover from impacts, for many different reasons.
2. Different types of impacts differ greatly in both likelihood that they cause substantial changes to ecosystems and the likelihood that recovery from the changes will be rapid and secure.
3. Ecosystems will not follow the same path during recovery that was taken during the period when the perturbation was occurring.
4. Ecosystems are naturally variable, so even a successful recovery program will not return an ecosystem to exactly the state is was in prior to the perturbation.
5. What point constitutes recovery – presence or maturity?

5.4 Integrated management (IM) and the ecosystem approach (EA) to fisheries

Biodiversity considerations are a major component of bringing both the ecosystem approach and integrated management into fisheries. They are part of both major challenges in IM and EA, dealing with:

Multiple effects – Accounting for multiple forcers in setting objectives, choosing indicators, setting reference levels, and diagnosing causes of changes. The latter is of particular concern because of the resultant difficulty in determining what activity (manageable or not) is causing a detrimental trend in a biodiversity feature, or if improvements in a biodiversity feature are due to management actions that have been taken or a natural process.

Complexity of management options – How to account for pressures from multiple human activities and how to allocate necessary mitigation actions fairly and effectively among multiple user communities. This is a challenge even when harmonizing management options across sectors for a single ecosystem feature such as stock fished by several fisheries. It becomes much more complex when management options must be harmonized across many groups with different goals, and considering many different biodiversity features.

Table 1. A summary of suggested measures and their relevance in mitigating the impacts of overfishing, destructive fishing practices and illegal, unreported and unregulated (IUU) fishing on marine biodiversity and habitats. The level at which the suggested measures are expected to have a positive impact on marine biodiversity and habitats are subdivided according to the following levels: (1) ecosystem-level; (2) habitat-level; (3) species-level; (4) population-level; and (5) genetic-level. This table focuses on the main effects of the measures.

	Measures	Overfishing	Destructive fishing practices	IUU	Considerations
1. International and regional instruments					
1.1	United Nations Convention on Law of the Sea	3, 4	3, 4	3, 4	For effective use of this legislation, fisheries management agencies and environmental agencies need to coordinate activities.
1.2	United Nations Fish Stocks Agreement	3, 4	3, 4	3, 4	For effective use of this legislation, fisheries management agencies and environmental agencies need to coordinate activities.
1.3	FAO Code of Conduct for Responsible Fisheries	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	For effective use of the Code, fisheries management agencies and environmental agencies need to coordinate activities.
1.4	International Plan of Action – IUU/ National Plan of Action – IUU			1, 2, 3, 4	IPOA-IUU is a voluntary instrument aims to improve monitoring, control and surveillance (MCS) and catch reporting systems, statistical systems (against non-reporting or misreporting), as well as developing and implementing specific international instruments and institutions. Identifies responsibilities for all States, flag States, coastal States, port States, States in applying agreed market measures and RFMOs. The IPOA-IUU needs to be translated into national plans of action (NPOA-IUU) and regional ones (RPOAs) as soon as possible.

1.5	Ecosystem approach to fisheries	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	Fisheries governance must be modernized, adopting formally and implementing effectively the ecosystem approach to fisheries (and the precautionary approach to fisheries), adaptive management processes, participative decision-making and implementation. For all fisheries, formal EAF-based plans should be adopted. The EAF process is the place where the harmonization of fisheries and biodiversity objectives must be achieved. The EAF process allows the major biodiversity issues associated with a fishery to be identified, as a basis for the selection of tools to address them.
1.6	Convention on International Trade in Endangered Species (CITES)	3	3	3	Aiming at protecting species that are clearly threatened by international trade. A memorandum has been signed between FAO and CITES which collaborate towards adapting CITES criteria to fishery species.
1.7	IUCN Red List of Endangered Species	3, 4	3, 4	3, 4	Identifies species or populations whose viability may be threatened directly or indirectly by fisheries, and where the need for conservation measures is particularly urgent.
1.8	Strengthening of regional fisheries management organizations (RFMOs)	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	Play a central role in coordinating States efforts and establishing multilateral measures. Implement measures to control overfishing, increase collaboration with other mechanisms or organizations to address biodiversity concerns. Only vehicle by which fisheries managers may deal with destructive practices beyond national jurisdiction. RFMOs should be developed in areas currently not covered.

1.9	Global Plan of Action for the Protection of the Marine Environment	1, 2	1, 2		Address marine environmental issues such as pollution, wastewater discharge, nutrients inputs etc. which have direct relevanceto fisheries and biodiversity.
1.10	Regional seas and associated Action Plans	1, 2	1, 2		Provide protocols for dealing with issues directly related to fisheries and biodiversity including specially protected areas, integrated coastal management, and pollutants.
1.11	The International Convention for the prevention of pollution from ships (MARPOL)	1, 2	1, 2		Deals with the prevention of pollution by garbage from ships. MARPOL Annex V completely prohibits discharge of synthetic fishing nets, however, the Annex does not apply to their accidental loss.
1.12	Coordinated science advice	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	Fisheries agencies and environmental agencies will often have to cooperate in the identification of risks of destructive fishing practices and development of appropriate mitigation strategies. Scientific advice is best produced by a single science advisory process, including an adequately broad range of experts from the full spectrum of professional perspectives. Integrated assessments will often be a key part of such science support.
1.13	Flag States control on fishing activities	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	See IPOA-IUU for details.
1.14	Port States control on fishing activities	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	See IPOA-IUU for details.
1.15	Coastal State responsibility	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	See IPOA-IUU for details.
1.16	Fishery development policy	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	Control and reduce overcapacity. Eliminate subsidies that fuel overcapacity. Address poverty and Develop alternative livelihood options for fishing communities.

2. Management measures					
2.1	Reduction of overcapacity	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	In some cases the biodiversity concern may be a highly localized ecosystem feature, such as rare habitat or rare and highly vulnerable species. In those cases even large reductions in capacity may not address the destructiveness of the practice effectively, unless additional measures are added to target the remaining fishing effort away from the biodiversity feature of concern. However, even when reduction in effort alone may not be adequate to eliminate the destructive consequences of a fishing practice, the reduction in capacity may be required for other measures to be implemented effectively.
2.2	Marine protected areas (MPAs)	1, 2, 3, 4, 5	1, 2, 3, 4, 5		MPAs designed for fisheries management need to be looked at in combination with the other management measures for the fishery, to ensure the suite of measures work together to achieve their fishery objectives. When direct enforcement capacity may be weak, the placing of “sleeping policemen” or “anti-trawling reefs” in near-shore vegetated areas with an accompanying warning to fishing vessels, is one way of discouraging mobile gears in shallow water closures.
2.3	Rotating harvest	2, 3, 4	2, 3, 4		Rotational harvest schemes can only protect vulnerable habitats when the rotation schedule is longer than the recovery time of the habitat.

2.4	Discard reduction	3, 4	3, 4		
2.5	Improved monitoring, control and surveillance (MCS)	1, 2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4, 5	When the ecosystem features potentially at risk of destructive impacts are spatially located, then remote systems like vessel monitoring system (VMS), may be effective, if connected to MCS capability, and accompanied by deterrent penalties in case of non compliance. When observers are present, additional measures to address potential destructiveness of fishing practices become available, such as flexible, real time closures of areas triggered by detection of the presence of vulnerable species or habitat features. Improved MCS capacity is essential for effective deterrence of illegal fishing, and is useful in fighting unreported and unregulated fishing.
2.6	Environmental impact assessment (EIA) and environmental risk assessment (ERA)	1, 2, 3, 4	1, 2, 3, 4		Should be conducted in line with the UN Resolution 61/105 and the International Guidelines for the Management of Deep-Sea Fisheries in the High Seas (FAO 2009, para. 47) and relevant national regulations. Adopting qualitative and/or quantitative environmental risk assessment as part of the EAF allows for early identification of the major risks of destructive fishing practices relative target species or biodiversity, and the development of strategies to avoid or mitigate the risks before the fishery is allowed to proceed.
2.7	Zoning		2, 3, 4		When interactions between gears are a significant factor in gear loss, a clear separation of trawling and netting activities would reduce gear conflict and loss.

2.8	Protecting vulnerable and critical habitat	1, 2, 3, 4	1, 2, 3, 4		Habitats that can easily be damaged by a fishing activity, with detrimental consequences for biodiversity. As such, when applied to habitats vulnerability is specific to particular fishing practices.
2.9	Protecting vulnerable species	3, 4, 5	3, 4, 5		Keeping fishing pressure low: When a species is vulnerable because of its life history, it is particularly important that fishing mortality on the population be kept very low, and that there is adequate MCS to ensure that the low mortality is achieved and maintained.
2.10	Banning destructive gear	1 ,2, 3, 4, 5	1, 2, 3, 4, 5		The deployment of mobile, bottom-contacting gears like trawls and dredges on highly vulnerable habitats should be prohibited, unless mitigation measures known to be effective in reducing habitat impacts are in place. Reducing poverty might be necessary in many places, in order to create the conditions where these particularly destructive techniques are abandoned by fishers, but the instruments are not in the fishery sector.
2.11	Eliminating dumping at sea		1, 2, 3, 4		Eliminating dumping at sea of derelict gear prevents the derelict gear from ghost fishing.
3. Technical measures					
3.1	More selective gear	3, 4	3, 4		These measures must be designed carefully, tested well and implemented as intended in the fishery.
3.2	More selective operation	3, 4	3, 4		Such controls must be designed carefully, tested well and implemented as intended in the fishery.
3.3	Reduce discard mortality	3, 4	3, 4		

3.4	Gear substitution	1, 2, 3, 4	1, 2, 3, 4		Gear substitution can be an effective measure to protect vulnerable habitats from destructive fishing practices, if the fishing practice being implemented has a much lower impact on the vulnerable habitat. The full range of potential consequences of the proposed gear substitution should be evaluated ecologically and socio-economically, to understand the possible costs and benefits of the change before it is implemented. Limitations to substitution of poorly selective fishing gear with cost effective alternatives include resistance to change, lack of economic incentives, availability of fish, compatibility of vessel and fishing gear, and operator experience. Using an alternative fishing gear may also affect the safety of the vessel and crew.
3.5	Gear modification	1, 2, 3, 4	1, 2, 3, 4		The full range of potential consequences of the proposed gear substitution should be evaluated ecologically and socio-economically, to understand the possible costs and benefits of the change before it is implemented.
3.6	Gear retrieval programmes	3, 4	3, 4		In case of significant accidental losses, programmes may be set up for recovery of lost gear.
3.7	Marking of fishing gear	3, 4	3, 4		Programmes to mark fishing gear will contribute to reducing detriment impacts of ghost fishing on biodiversity only when there are programs to retrieve lost gear and the capacity to inflict penalties on fishers for the loss of gear.

3.8	Using biodegradable material		2, 3, 4		For fishing gears that may be lost can contribute to reducing the impacts of ghost fishing on biodiversity whenever such materials will render lost gear ineffective at catching or retaining species. Further development and testing of gears using biodegradable materials is needed.
4. Socio-economic					
4.1	Access and user rights	3, 4	3, 4		Economic incentives through can be very effective in some cases, e.g. linking opportunities to fish to reducing catch of vulnerable or endangered species. When the destructiveness of a fishing practice is because of a highly vulnerable species or habitat, allocation of rights alone may not address the biodiversity concern. It may be possible to allocate directly rights to the biodiversity feature of concern, but this strategy is largely unproven and would require highly effective MCS. This requires social, economic and institutional settings that ensure defendable entitlements to the resource and other incentives aligning individual and societal expectations.
4.2	Education in marine conservation	1, 2, 3, 4, 5	1, 2, 3, 4, 5		Assist in making coastal communities more aware of the dangers of destructive fishing and of the solutions available to them.
4.3	Consumer action, ecolabelling and other market-related measures	1, 2, 3, 4, 5	1, 2, 3, 4, 5	3, 4	It is possible to build specific biodiversity considerations into these instruments and target specific biodiversity objectives. Market instruments cannot be assumed to provide biodiversity benefits unless they have been intentionally built into the specific application of a market instrument.

					Market instruments have potential to contribute to biodiversity concerns in many ways but their real end impacts on fishery and biodiversity outcomes are still being assessed. Many of these measures tend to be taken mainly on high-value species and should be adopted in a fair, transparent, and non-discriminatory manner. Their effectiveness largely depends on the cooperation and coordination between nationals and RFMOs.
4.4	Sustainable livelihoods	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	
4.5	Improve governance	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	Necessary to mitigate impacts from overfishing, destructive fishing practices and IUU fishing.

Table 2. Examples of fishing gears, possible types of impacts and mitigation measures relevant to biodiversity conservation.

Gear	Some potential adverse biodiversity effects	Possible mitigation measure
Dredges and bottom trawls	Impacts on sediment structure and fauna. Changes in the relative abundance of bottom fauna. Large numbers of fish may be damaged/killed by the gear but not caught. Damage to vulnerable habitats. Damage to vulnerable species.	• Promote spatial fisheries management (with VMS mandatory). • Develop and promote adoption of more selective fishing gear to reduce unwanted bycatch • No expansion of fishing activity into new areas without ERA, licence conditions / fishery management plans. • Installation of mapping and gear monitoring systems to assist in aimed trawling. • Ban operations that would result in significant adverse impacts to vulnerable marine ecosystems. • Develop practical and safe cost effective alternative fishing gears to reduce habitat damage (example pots, seines, longlines) in habitats of concern.
Gillnets and enmeshing gear	Entanglement and removal of emergent fauna (e.g. corals). Entanglement of vulnerable species such as marine mammals, sharks, turtles, seabirds.	• Restrict use of nets to depths less than 600 m and in areas with attached emergent epifauna (consider restricting use to low energy –low current/low wave areas). • Ensure gears are appropriately marked (traceability). • Encourage reporting of accidentally lost gears and recycling of unwanted/derelict fishing gears. • Develop further technologies that reduce marine mammal, sea turtle and seabird encounter with fishing gears. • Encourage use of technologies (such as biodegradable material) that reduce fishing power of lost nets and aid in their retrieval. • Limits to number of nets can reduce overall fishing power. • Avoid setting gears in the vicinity of vulnerable species migratory pathways and near breeding colonies/nesting sites.
Purse seines	Catches of juvenile tunas, sharks, marine mammals and marine turtles. Discards.	• Promote training in, and adoption of techniques to reduce entrapment of vulnerable species and safe release of unwanted bycatch. • Marking of fish aggregating devices (FADs). • Reporting of accidentally lost gears FADs.

		• Ban slipping of catches. • Promote technology to determine fish size prior to making a set.
Longlines	Bycatch of vulnerable species (sea turtles, seabirds, etc.). Abandoned parts of the gear may continue entangling vulnerable species.	• Research, development and promotion of more selective fishing gears/practices to reduce unwanted bycatch species including: – turtles-hook size and shape; – seabirds – tori lines, weighted bait, bait colour, offal discharge, reduced lighting, and shooting arrangements; – fish species (branchline length, hook shape and size, bait properties, gear setting configuration). • Research and development of environmental factors (setting time, moon phase, temperature, etc.) that contribute towards reduced bycatch species. • Avoid setting gears in the vicinity of vulnerable species migratory pathways and near breeding colonies. • Encourage reporting of accidentally lost gears and recycling of unwanted/derelict fishing gears.
Harvesting by divers and hand collecting	High efficiency leading to overexploitation/depletion (e.g. red coral in the Mediterranean, shell-collection, habitat destruction over-harvesting of sea dates and of sea cucumbers).	• Ban in areas formally designated as sensitive areas.
Explosives	Highly destructive.	• Implement ban.
Poison	Highly destructive.	• Implement ban.
Coral “bashing”	Highly destructive.	• Implement ban.

APPENDIX 1

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APPENDIX 2

Agenda and timetable

23 September 2009, Chair S. Garcia			***Rapporteurs***
09:00-09:15	Opening. FAO Welcome. Adoption of the agenda. *Modus operandi*	G. Bianchi/ S. Garcia	G. Bianchi/ M. Tandstad
09:15-10:45	Definitions: Introduction and discussion	S. Garcia/All	G. Bianchi/ M. Tandstad/ J. Rice/J.Lee
10:45-11:00	Coffee break		
11:00-13:00	Unsustainable fishing: Introduction and discussion	W. Cheung/All	W. Cheung/ R. Hilborn/ J. Rice/J. Lee
13:00-14:00	Lunch break		
14:00-16:00	Unsustainable fishing: discussion (cont.)	All	W. Cheung/ R. Hilborn/ J. Rice/J. Lee
16:00-16:15	Coffee break		
16:15-17:30	Unsustainable fishing: discussion (cont.)	All	W. Cheung/ R. Hilborn/ J. Rice/J. Lee
18:00-19:00	Drafting	W. Cheung, M. R. Hilborn J. Rice/J. Lee	
24 September 2009, Chair S. Garcia			***Rapporteurs***
08:30-10:45	Destructive fishing: Introduction and discussion	J. Caddy	J. anticamera/ D. Ferro/ J. Rice/J. Alder
10:45-11:00	Coffee break		
11:00-13:00	Destructive fishing: Discussion (cont.)	All	J. Anticamera/ D. Ferro/ J. Rice/J. Alder
13:00-14:00	Lunch break		
24 September 2009, Chair S. Garcia			***Rapporteurs***
14:00-16:00	IUU fishing: Introduction and discussion	W. Cheung/All	J. Anticamara/ M. Kuruc/ J. Rice/J. Alder
16:00-16:15	Coffee break		
16:15-17:30	IUU fishing: Discussion (cont.)	All	J. Anticamara, M. Kuruc/ J. Rice/J. Alder

25 September 2009, Chair S. Garcia			***Rapporteurs***
08:30-10:45	IUU fishing: Discussion (cont.)	All	J. Alder/ J. Lee/ S. Garcia
10:45-11:00	Coffee break		
11:00-13:00	Adoption of the report	All	
13:00-14:00	Lunch break		
14:00-16:00	Adoption of the report	All	
16:00-16:15	Coffee break		
16:15-17:30	Adoption of the report	All	

Following a decision by the Conference of the Parties to the Convention on Biological Diversity (CBD) at its ninth meeting (Bonn, 19 to 30 May 2008), the CBD Secretariat, the United Nations Environment Programme (UNEP) and FAO collaborated in the compilation of a report on the impacts of destructive fishing practices, unsustainable fishing, and illegal, unreported, and unregulated (IUU) fishing on marine biodiversity and habitats. A working document was first prepared that informed an international Group of Experts, through an Expert Meeting which took place at FAO in Rome from 23 to 25 September 2009. This document is the main output of that meeting and includes: (i) key conclusions on the impacts of unsustainable fishing, destructive fishing practices and IUU fishing on marine biodiversity and habitats; and (ii) elements of policy and management aiming at the mitigation, reduction and, where possible, elimination of the impacts of fisheries on biodiversity and habitats, to be considered by Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 14) and the tenth meeting of the Conference of the Parties (CoP 10) in 2010.

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