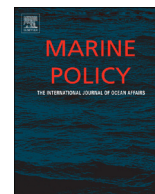




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Marine Policy

journal homepage: www.elsevier.com/locate/marpol

Mainstreaming biodiversity in fisheries

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ARTICLE INFO

Keywords:

Biodiversity
Mainstreaming
Sustainable development
Fisheries
Conservation
Cooperation

ABSTRACT

Biodiversity mainstreaming, the consideration of biodiversity across fisheries and the range of actions taken by both fisheries and conservation governance streams is the subject of this paper. Evidence is presented that the global fishery community incrementally adopted sustainable development principles from both before and after the 1992 adoption of the Convention on Biological Diversity, integrating a broader set of ecosystems goals into fisheries. Actions taken by the Food and Agriculture Organization of the United Nations (FAO) and regional and national fishery agencies to fulfil their mandate are discussed, in addition to objectives for more sustainable fisheries that have led to significant expansions in legal frameworks, policies and practices in terms of biodiversity conservation. The paper also highlights the growing importance of cross-sectoral cooperation in the resolution of historical disagreements between fisheries and environmental interests, in spite of the various sectoral interests. In this evolution, despite many target stocks not yet being sustainably managed, fisheries approaches are progressively focusing on a broader range of biodiversity considerations, whereas conservation interests are increasingly adopting more socially inclusive approaches. Looking ahead to the future, biodiversity conservation will continue to be of growing importance in fisheries, and presented here, are examples of how past and on-going developments in fisheries challenge the pessimistic picture promoted by some environment-focused advocacy papers. To continue this successful mainstreaming, greater implementation efforts are needed to deliver outcomes at all scales, requiring greater capacity, particularly in developing countries and strengthening of investment in integrated partnerships between fisheries and environment sectors.

1. Introduction

Mainstreaming biodiversity considerations in sectoral management has acquired a substantial profile since the adoption of the Convention on Biological Diversity (CBD) in 1992. In the case of fisheries, the consideration of biodiversity through the adoption of more broadly focussed, science-based governance approaches finds its roots in the concept of natural resources management (NRM) or wildlife management [79,80], which has evolved and expanded to include more integrated operational paradigms [31].

“Mainstreaming” of biodiversity has a variety of definitions and interpretations across different sectors. The Global Environmental Facility’s (GEF) Scientific and Advisory Panel (STAP) define it well, as:

“the process of embedding biodiversity considerations into policies, strategies and practices of key public and private actors that impact or rely on biodiversity, so that it is conserved and sustainably and equitably used

both locally and globally [68,69]”.

This definition captures how biodiversity considerations are integrated across sustainable development processes and related activities, requiring a coherent and cross sectoral strategy demonstrating strong technical knowledge of the impacts of each activity in question [and] the involvement of a broad range of stakeholders.¹

For capture fisheries (referred to as the “fisheries sector”), a suggested definition of mainstreaming is:

“the progressive, interactive process of recognizing the values of biodiverse natural systems in the development and management of fisheries, accepting full accountability for, and effectively responding to, the broader impact of fishing and fishery related activities on biodiversity and related structure and function of ecosystems”.

In other words, appreciation for the market and non-market values of biodiversity and the provisioning and regulatory services that

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¹ See another example, <http://ncsp.undp.org/topics/mainstreaming-climate-change>.

<https://doi.org/10.1016/j.marpol.2018.03.001>

Received 14 August 2017; Received in revised form 1 March 2018; Accepted 1 March 2018
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ecosystems provide, while having accountability for the full footprint of fishing and fishery related activities.

In this paper, it is argued that the consideration of biodiversity in fisheries has been progressing, at both the global and local scales, because i) the fisheries sector and its practitioners are embracing a broader range of ecological considerations across their core work; ii) the “environment sector” (conservation biology, environmental and wildlife-focused initiatives and conventions) is advocating greater biodiversity considerations into fisheries policies and practices effectively, or iii) a combination of both, when the two sectors work collaboratively. What is clear is that a cross-sectoral recognition of its purpose is fundamental to progress in biodiversity mainstreaming. Such recognition benefits from fundamental similarities in the strategic visions of each; two of the three goals of CBD for biodiversity are “conservation” and “sustainable use”,² whereas in the fisheries sector “resource conservation” and “responsible fisheries” (leading to “sustainable use”) are key goals [64]. The overlap is obvious.

The mainstreaming of biodiversity in agriculture, fisheries, forestry and tourism was the overall conference theme at the 2016 United Nations Biodiversity Conference [118]. In many of its events the view of mainstreaming was presented as a new and deliberate process taken by sectoral governance actors, with the intent of integrating biodiversity considerations directly into their operational paradigms. In this paper a contrasting view for fisheries is presented, in that mainstreaming be appropriately viewed as an outcome of long-term shifts in policies and practices. Ultimately, many paradigm shifts in fisheries have occurred over time, delivering long-term convergence towards biodiversity mainstreaming - the environment sector's desired outcome.

In this paper the problems and challenges facing fisheries are not disregarded [40], however the journey of biodiversity consideration across the fisheries sector is the main focus, its successes, on-going deficiencies and gaps. The authors also suggest further work that is needed to deliver full coherent legal frameworks, policies and practices across the fisheries and environment sectors, with relevant examples provided, including suggestions to further strengthen cross-sectoral collaboration in mainstreaming.

2. Background

The use of the term “biodiversity” in fisheries broadens the sector's perspective beyond the resources available for harvesting so as to include all parts of nature including components not intentionally harvested, but potentially contributing to ecosystem structure and function [12,94]. Both the concepts of biodiversity and ecosystem structure and function have evolved in the last century of ecology and resource management. Historically, the term “ecosystem” was only introduced in 1935 [133] and the concept of “biodiversity” was not yet in common use in the 1980's [47]. However, the diversity of life has received burgeoning attention across the environment and fisheries sectors, as society has gained a more sophisticated understanding of the scope, value and vulnerability of biodiversity and the complex interconnectivity of natural systems [5,6,26,88,98].

In all resource management this broadening of focus received growing consideration after the Second World War, and was again strengthened in the 1980s through the adoption of the World Conservation Strategy (WCS, [74]). The outcomes of the 1992 United Nations Conference on Environment and Development (UNCED), and its Agenda 21 further increased demand for conservation of biodiversity and resulted in the opening for signature in mid-1992 of the Convention on Biodiversity (CBD) that came into force at the end of 1993. The CBD which now has 196 Members (Parties) strengthened the policy framework and implementation capacity for i) the conservation of biological diversity (or biodiversity); ii) the sustainable use of its components; and

iii) the fair and equitable sharing of benefits arising from genetic resources.

The concept of “sustainable development” moved quickly after the WCS, to be enshrined in the report of the World Commission on Environment and Development (Brundtland Commission 1983–1987), that re-defined the societal view of development, accounting for the need to maintain “*the ability of future generations to meet their own needs*” when considering a development agenda [127,130]. The provisions of the World Summit on Sustainable Development in 2002³ presented a more integrated approach to development and sustainable natural resource management, recognizing the need to i) maintain essential ecological processes and life support systems, ii) preserve genetic diversity and iii) ensure the sustainable utilization of species and ecosystems.

This broadening of focus was occurring in the marine realm as well as terrestrially [51,52,90,92,113]. Growing interest in sustainable development, and the need for greater guidance in the exploitation of resources in contrast to the “freedom of-the-seas doctrine”, resulted in the adoption of a binding UN treaty, the 1982 Law of the Sea Convention (LOSC). This treaty held instructions on “the exploitation regime”⁴ and, to a lesser extent, “protection of the marine environment”,⁵ including provisions that showed due regard for both target species in fisheries and *associated and dependent species* that together are key parts of marine biodiversity.

The impetus from UNCED and CBD for greater consideration of biodiversity was felt in the management of all sectors depending or impacting living resources, directly or indirectly [78]. The environment sector's objective of mainstreaming biodiversity across economic development sectors was embodied in hundreds of projects supported from the late 1990s onwards by the Global Environment Facility (GEF). These projects were most numerous in agriculture and forestry [68], although all use sectors received some attention across scores of countries.

Biodiversity impacts were already a focus for fisheries prior to the 1980s [64], as reports on the effects of differing gears, bycatch, habitat impacts and the perturbations of trophic relationships on the ecosystem accumulated in sector literature [71,113]. Although they did not refer to the mainstreaming of biodiversity considerations initially, FAO, the UN agency with competence for fisheries, together with many leading States, increased their focus on the environmental goals for sustainable fishery development: this is evident in the seminal Code of Conduct for Responsible Fisheries (CCRF, [27]) that provides guidance on principles and standards on management and conservation of marine life and the aquatic environment.

The CCRF highlights the need for protection (and/or rehabilitation) of not only target species (Articles 6.3, 7.1.8, 7.2) but also non-target, associated or dependent species and habitats (Articles 6.2, 6.8, 8.7, 8.8, 8.11) including on the monitoring, use and sharing of scientific information (Articles 6.4, 7.1, 7.4, 8.1, 12.4). The CCRF sets fisheries in a broader context in respect to management and conservation frameworks (Articles 6.9, 7.1, 7.3, 9.3, 10, 11), urges application of the precautionary principle (Article 6.5, 7.5), the use of selective fishing gears (Article 6.6, 7.6, 8.5) and the minimizing of waste, discards, ghost-fishing and bycatch (Articles 6.7, 7.2, 7.5, 7.6 and 8.5). Illustrative of the broad focus of the CCRF, Article 7.2.3 examines fisheries activity in the context of ecosystems:

“.....and species belonging to the same ecosystem or associated with or dependent upon the target stocks, and assess the relationship among the populations in the ecosystem”.

³ World Summit on Sustainable Development (WSSD). <https://sustainabledevelopment.un.org/milestones/wssd>.

⁴ conservation and management of living marine resources.

⁵ http://www.un.org/depts/los/convention_agreements/convention_historical_perspective.htm.

² <https://www.cbd.int/2011–2020/about/goals>.

Table 1

A selection of FAO-based initiatives and guidance on fisheries that support the CCRF and highlight the consideration of biodiversity across fisheries^a.

Issue and action	Date
Instruments, guidelines and international plans of action^b	
● Code of Conduct for Responsible Fisheries (CCRF)	1995
● Technical guidelines for responsible fisheries	1995
● Precautionary approach to fishery management and species introductions ^c	1995
● Integration of fisheries into coastal area management	1996
● Guidelines: Integrated management of agriculture, forestry and fisheries [117]	1998
● Indicators for sustainable development of marine capture fisheries	1999
● IPOA Sharks (1999). Conservation and Management of Sharks (2000)	1999
● IPOA Turtles - Guidelines to reduce sea turtle mortality in fishing operations	1999 start
● IPOA Seabirds - Guidelines to reduce incidental catch of seabirds in longline fisheries	1999
● IPOA IUU Fishing	2001
● Ecosystem Approach to Fisheries EAF (Toolbox; Net) ^d . Ecosystem Modelling (2008)	2002
● Alien Species in Fisheries (2003). Freshwater Invasive (2013)	2003
● Int. Guidelines for the ecolabelling of fish and fishery products from marine capture fisheries	2005
● Guidelines for the management of deep-sea fisheries in the high seas	2008
● Genetic resource management in aquaculture	2008
● Guidelines to reduce sea turtle mortality in fishing operations	2009
● Ecolabelling of fish and fishery products from marine capture fisheries	2009
● Deep-sea fisheries in the high seas	2009
● Ecosystem approach to aquaculture	2010
● Guidelines on Bycatch Management and Reduction of Discards	2011
● Guidelines on Marine Protected Areas and Fisheries	2011
● Strategy for fisheries, aquaculture and climate change	2012
● Guidelines on gear marking, reporting, recovery of ALDFG (draft)	2016
Information, data systems and networks	
● FAO Capture Production Statistics ^e . FIRMS ^f (both updated annually)	1950 start
● Species List ASFIS ^g ; Species Identification ^h iMarine AppliFish + BiOnym	1970's start
● FAO SOFIA reporting on progress and trends in fisheries (biennial)	1994
● Database on introduced aquatic species (DIAS ⁱ)	2000
● Fisheries and aquaculture fact sheets and geospatial products	2000 start
● Expert panel advice on determination of threatened species status (triennial ^j)	2004
● FAO review on the implications of climate change for fisheries and aquaculture	2009
● Country questionnaire on implementation of CCRF (biennially)	2011
● Vulnerable marine ecosystems database ^k , iMarine MPA information system	2014, 2017
● Sharks measures database ^l	2015
● Vulnerable marine ecosystems: Processes and practices in the high seas	2016
● FAO state of the world's aquatic genetic resources ^m	2017
Technical assistance and capacity development through field programs	
● Fridtjof Nansen Program ⁿ (1975); EAF-Nansen Project (2006)	1970's
● Large Marine Ecosystem (LME) ^o and Inland aquatic ecosystems projects	2009, 2014

^a Also see, <http://www.fao.org/fishery/publications/technical-guidelines/en> and FAO's tools and guidance to assist implementation of the CBD and the Strategic Plan for Biodiversity 2011–2020, www.fao.org/3/a-i4811e.pdf.

^b <http://www.fao.org/fishery/publications/technical-guidelines/en> and <http://www.fao.org/fishery/publications/international-guidelines/en>.

^c <http://www.fao.org/docrep/003/w3592e/w3592e07.htm>, also see Mace and Gabriel, 1999.

^d Toolbox approach <http://www.fao.org/fishery/eaf-net/toolbox/en>; the EAF Net www.fao.org/fishery/eaf-net/en.

^e <http://www.fao.org/fishery/statistics/en>.

^f <http://firms.fao.org/firms/en>.

^g <http://www.fao.org/fishery/collection/asfis/en>.

^h <http://www.fao.org/fishery/fishfinder/en>.

ⁱ <http://www.fao.org/fishery/dias/en>.

^j <http://www.fao.org/fishery/cites-fisheries/ExpertAdvisoryPanel/en>.

^k <http://www.fao.org/in-action/vulnerable-marine-ecosystems/en/>.

^l <http://www.fao.org/ipoa-sharks/database-of-measures/en/>.

^m <http://www.fao.org/fishery/AquaticGeneticResources/en>.

ⁿ <http://www.fao.org/in-action/eaf-nansen/en>.

^o For example www.boblme.org/ or www.fao.org/in-action/canary-current-lme/en/.

Subsequent FAO publications offer guidelines on sustainable indicators, precautionary and ecosystem approaches, all of which directly contributed to the greater inclusion of a biodiversity focus in fisheries policy and management ([4,75,119] see Table 1).

The efforts by fisheries authorities were complemented by comparable efforts from several IGOs and NGOs in the environment sector, including the United Nations Environment Programme (UNEP), the International Union for Conservation of Nature (IUCN), CBD, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). In that parallel process, the environment and wildlife conservation authorities and advocacy groups promoted a

diverse array of policy positions related to overfishing, vulnerable and protected species, bycatch and discards, destructive fishing practices, impact on habitats, illegal fishing, trade-related threats etc., calling for the improved management and conservation of fisheries, and an expanded use of tools to further these aims, such as marine protected areas and trade controls.

International law does not require fishery governance actors to adopt each and every measure advocated by the full range of specialized environmental interests to demonstrate sectoral mainstreaming of biodiversity considerations [109,110,127]. However, national fishery authorities are legally bound to meeting conservation standards

articulated within the LOSC and later instruments, and interpretation of these instruments were influenced by developing global understanding of biodiversity, its value and the emergent societal norms, as articulated in the policies of competent international organizations such as the CBD [53].

Conversely, conservation advocates are increasingly expected to recognise and accommodate people as an integral part of the environment and, as part and parcel of the natural world, to accept the use of biodiversity as long as it is sustainable [13,23,120]. Signs of such shifts are apparent as the environment sector adapts approaches that exclude people to “protect” nature, to approaches that protect people and nature, with better recognition of the value of community participation in the management of human pressures [84,127].

3. The CBD, its strategic plan and Aichi Targets

The CBD and its Cartagena and Nagoya Protocols are the principal global instruments on the conservation of biodiversity. At its tenth meeting in 2010, the Conference of the Parties (COP) to the Convention adopted the Strategic Plan for Biodiversity 2011–2020 along with time-bound biodiversity targets, collectively known as the ‘Aichi Biodiversity Targets’.⁶ These targets aim to directly address the underlying causes of biodiversity loss, reduce the direct pressures on biodiversity, improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity, enhance the benefits to all from biodiversity and ecosystem services, and enhance implementation through participatory planning, knowledge management and capacity building.

Several of these Aichi Targets are relevant for fisheries; Target 1) raising awareness on biodiversity value and sustainable use; T2) integrating these values in development and poverty reduction; T3) eliminating subsidies, minimizing impacts and providing incentives; T4) planning for sustainable production within safe limits; T11) integrating MPA networks and other effective area-based measures; T12) preventing extinction and T18) integrating traditional knowledge in fully participative governance. However, T6 focusses primarily on fisheries and encapsulates practically all related societal expectations (see below).

Targets 6 and its parallel, Target 7 for agriculture, forestry and aquaculture are of particular relevance to mainstreaming in commercial sectors which make use of, or otherwise impact biodiversity. These were commitments, adopted by consensus of Parties to the CBD,⁷ that can be taken as international norms for conservation and sustainable use of biodiversity. The term “mainstreaming” is not present in Targets 6 and 7, nor was it dominant in the negotiations. Nevertheless achievement of these targets by the relevant economic sectors would constitute meeting the international norms set by CBD, thus represent mainstreaming biodiversity in those sectors.

Targets 6 and 7 differ conspicuously in their level of detail. Target 7 (“By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity”) describes only a high-level outcome for biodiversity, without specifying norms for how such management would be ‘sustainable’ or ‘conserve biodiversity’, and requires substantial interpretation to be operational and verifiable. This is in spite of the clearly articulated impacts of these sectors on biodiversity ([21,102]; FAO⁸).

By contrast Target 6 is more exhaustive⁹:

By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that:

- i. *overfishing is avoided;*
- ii. *recovery plans and measures are in place for all depleted species;*
- iii. *fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems; and*
- iv. *the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.*

Both Targets include a reference to sustainability of harvests in the introduction, however, for Target 6 there is also a specific focus on the “legality” of harvests that addresses the desire to eliminate illegal fisheries. A reference is also included to the “ecosystem-based approach”, a well-established concept in global policy on conservation and sustainable use,¹⁰ but much like legality, one not explicitly referenced in the target for terrestrial biodiversity use. Moreover, the fishery target not just requires “sustainability”, but specifies four outcomes to be achieved for fishery to be considered sustainable.

Point (i) covers the impact on target species, for which ‘overfishing is avoided’. In this case, well established technical standards for “overfishing” and rebuilding of target species exist,¹¹ developed and refined by fisheries authorities since the early 1900s.¹²

Point (ii) outlines conditions for target stocks that have been overfished. The phrasing employed acknowledges that complete rebuilding may take a number of years (i.e. not achieved by 2020) but requires that plans are not just ‘developed’ (initial phrasing during negotiation of the target), but also “in place”, i.e. actively implemented.

Despite markedly lower losses of marine biodiversity when compared to the terrestrial equivalent [86,103], the impacts of fisheries on species at risk and special habitats were explicitly addressed in point (iii), a concern present in conservation biology for some time [85,106]. The expression “no significant adverse impacts” was explicitly used to ensure consistency in international standards across documents, and links to the more extensive provisions for protection of vulnerable marine ecosystems in United Nations General Assembly (UNGA) Resolution 61/105.

The final component, point (iv), extends from individual stocks to aggregate impacts of all fisheries on species, ecosystem structure and function. The requirement of impacts to be ‘within safe biological limits’ was chosen because the standard was also already well established in both fisheries [33] and the environment sectors [96], and is considered operational.

The subcomponents of Aichi Target 6, were developed and adopted by countries without much controversy. The “Friends of the Chair” group developing Aichi 6 Target comprised Delegates from all six inhabited continents, with observers representing both fisheries’ interests and ENGOs. Achieving consensus in the formulation of Target 6 required only four hours, with most time spent organizing the sub-components of the target into the groupings (reflected in the bulleted phrases in the previous sections) and matching the precise language to other agreements. At no time did “fishery-friendly countries” or FAO or RFB observers raise concerns, and the Plenary approved the draft target

¹⁰ <https://www.cbd.int/ecosystem>.

¹¹ The LOSC does not use the term overfishing. However, it requires that target stocks be maintained at levels which can produce the maximum sustainable yield [MSY], as qualified by relevant environmental and economic factors, etc. (Article 61.3). For associated and dependent species, it requires maintaining or restoring populations of associated or dependent species above levels at which their reproduction may become seriously threatened (Article 61.4). Fishing harder than required to be and stay at these levels is “overfishing”. A stock that has been reduced below these levels is “overfished” whether the fishing pressure is still excessive or not.

Finally, “overfishing” was defined as a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis. [Sustainable Fisheries Act, 16 U.S.C. §§1801–1882 (1996)]. <https://definitions.uslegal.com/o/overfishing/>.

¹² Depending on the particular country, “overfishing” is defined as a situation in which the stock biomass is below the benchmark, fishing pressure is above the benchmark, or both. The benchmark referred to is either the MSY level (as in the LOSC) or the minimum safe biomass level, below which reproduction is threatened.

⁶ <https://www.cbd.int/cop10/>.

⁷ At the same time, States took other compatible provisions, in IMO, FAO, IAEA, etc.

⁸ <http://www.fao.org/forestry/environment/en/>.

⁹ Formatting (bullet points) added for ease of reference within this manuscript, but wording is unaltered from the COP decision.

with little debate, suggesting an overall coherence in global thinking (including that of fisheries stakeholders).

Taken together, the Target 6 provisions spell out exactly the standards that the Parties to the CBD expect of fisheries. The adoption of Aichi Target 6 (and more recently Sustainable Development Goal 14) reflects that global societal expectation and commitment to the conservation of biodiversity in sectoral management is well accepted.

4. Fishery and FAO consideration of biodiversity in global fisheries

As a marine sector both dependent on biodiversity as a resource and impacting it directly and indirectly through harvesting practices, the consideration of biodiversity in fisheries policies and management measures is highly relevant to its conservation and sustainable use. At the global scale the UNGA addresses both fisheries and marine conservation issues through its resolutions on Sustainable Fisheries, and on Oceans and the Law of the Sea. FAO, with mandates for providing its 194 member countries and RFBs with guidance on responsible fisheries management, promoting a food secure world and productive, sustainable and economically viable fisheries,¹³ has led evolving efforts to develop and promote the enabling policy and regulatory framework for sustainable development of fisheries.

To deliver its mandate, FAO recurrently monitors the evolution of fisheries (for example, through the FStatJ,¹⁴ FIGIS¹⁵ and FIRMS¹⁶ systems) and reports on capture production, culture and trade of living resources through ‘The State of World Fisheries and Aquaculture’ [40], and issues related to Aquatic Genetic Resources [66]. FAO works through the Regional Fishery Body Secretariats’ Network (RSN), its 11 Regional Fishery Bodies (RFBs) established under either Articles VI or XIV of the FAO Constitution, in addition to approximately 50 RFBs (including Regional Fisheries Management Organizations, RFMOs) around the world to support its activities, publish research, and raise awareness on a diverse range of fisheries issues.

FAO’s consideration of biodiversity has been addressed to an increasing extent since the British Government convened the final of three international conferences on overfishing [90]. As biodiversity conservation norms were elaborated in LOSC, WSSD, UNCED and the CBD, the FAO Committee on Fisheries (COFI) was the primary forum for response and guidance. By the time that the overarching CCRF was adopted in the mid-1990s, biodiversity concerns were explicitly included in provision 12/10, which specifies:

“States should carry out studies on the selectivity of fishing gear, the environmental impact of fishing gear on target species and on the behaviour of target and non-target species in relation to such fishing gear as an aid for management decisions and with a view to minimizing non-utilized catches as well as safeguarding the biodiversity of ecosystems and the aquatic habitat”.

Following the adoption of the CCRF, the 2001 Reykjavik Declaration [32] laid the foundations for a broad ‘Ecosystem Approach to Fisheries’ (EAF) within national fisheries departments and RFBs (in areas within and beyond national jurisdictions). The EAF built on past fisheries management paradigms, amalgamating the emerging paradigm of ecosystem management with conventional fisheries management [31]. This commitment, in turn prompted COFI to request extra work on assisting the delivery of provisions found in the CCRF concerned with fisheries impacts on the ecosystem – and hence on biodiversity (see Table 1) – more fully.

¹³ Information delivery, provision of neutral fora, policy advice, establishment of methodologies for development and adaptation, technology transfer, development and strengthening of human resources and institutions, and technical assistance.

¹⁴ <http://www.fao.org/fishery/statistics/software/fishstatj/en>.

¹⁵ Fisheries Global Information System.

¹⁶ Fishery Resources Monitoring System.

Adopted in 2001 the EAF:

“strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries [31,32]”.

The EAF therefore explicitly recognizes the complex and dynamic connections between fisheries and the broader ecosystem.¹⁷ Its language about fisheries addressing the multiplicity of societal needs, without jeopardising the options for future generations to benefit equally from marine ecosystems [7,8,55,72], is similar to the language used in UNCED and WSSD.

Delivery of ecosystem-based principles has been achieved through incremental adaptive approaches, at scales from global to local [75]. FAO and others independently contributed to implementation with tools and instruments such as indicators of sustainability [2,43,54], the precautionary approach [50] and guidance on destructive fishing practices (Table 1).¹⁸ Progress in the degree of uptake and integration of such global agreements, activities and tools across national and regional policy and legal frames and mandates have varied greatly depending on local conditions and the level of political support [75,127].

While there is recognition that many target stocks continue to decline, especially in developing countries with weak capacity for assessment and monitoring, control and surveillance [40], many developed (e.g. Norway, Iceland, USA, UK, Australia) and developing nations (e.g. South Africa, Mozambique, Mauritius, Cameroon),¹⁹ have augmented their national laws and sectoral policies²⁰ expanding ecosystem considerations in fisheries management [43,65,129]. These approaches are being more broadly adopted as capacity is developed, resources are secured and such considerations receive political support [37,67,99–101,121].

A self-assessment for measuring implementation of EAF, conducted by the EAF Nansen Project across 13 countries in the Fishery Committee for the Eastern Central Atlantic South area (i.e. all the countries in West and Central Africa from Sierra Leone in the north to the Democratic Republic of Congo) recorded its lowest score, 30 percent, against the standard of “the managing authority having a good understanding of the ecosystem impacts of fisheries”, whilst the highest score was recorded against “the managing authority having transparent and participatory management structures in participatory processes” [38]. In countries bordering both the African Atlantic and Indian oceans within the ambit of the EAF Nansen Project, performances scores ranging from 30 percent to 70 percent of the standards, for measuring a baseline for implementation of EAF.

Analogous policy changes are seen across areas beyond national jurisdiction, where the UNGA has adopted a series of resolutions, beginning with Resolution 59/25 in 2004, which called on high seas fishing nations and RFMOs to take urgent action to protect vulnerable marine ecosystems (VMEs) from destructive fishing practices [128]. Following the adoption of UNGA resolution 61/105 in 2006, and the

¹⁷ It can be noted that the EAF Guidelines of FAO scarcely refer to “biodiversity”, but refer instead, more specifically, to ecosystem structures and components, e.g. target species, associated and dependent species, bycatch, and habitats for which specific measures can be advocated.

¹⁸ <http://www.fao.org/docrep/011/i0150e/i0150e00.htm>.

¹⁹ See implementation assessment of EAF across SWIOFC region, as a means of monitoring achievement of the World Summit on Sustainable Development (WSSD). SFS/DM/SWIOFC/15/INF. 5 Report of the Sixth Session of the Scientific Committee of the South West Indian Ocean Fisheries Commission, 18–21 March 2015, Dar-es-Salaam, Tanzania. For South Africa see [19].

²⁰ EU: Good Environmental Status, MSFD, and ecosystem-based approach to fisheries management’ means an integrated approach to managing fisheries within ecologically meaningful boundaries, Common Fisheries Policy 2014. USA. Executive Order 13547. Norway: Act of 6 Jun. 2008 No. 37 on the Management of Wild Living Marine Resources. Russia: Federal law N 166-P3 20/12/200.

Table 2

Progression in the status of governance measures and controls across RFMOs adopted and in place in 2006 or before (dark fill) or after 2006 but in place in 2017 (light fill). Table adapted from an unpublished report ([49], also see Table 1. in [89]).

Governance measures & controls	NAFO	NEAFC	SEAFO	GFCM	CCAMLR	SPRFMO ¹ 2013	NPFC ² 2015	SIOFA ³ 2016
1. Fishery monitoring, control, surveillance								
a. Target catch/effort								
b. Vessel list								
c. Vessel monitoring (VMS)								
d. Observers								
e. IUU measures								
f. Port measures or PSMA								
2. General biodiversity considerations								
a. Non-target species								
Seabirds								
Sea turtles								
Sharks and rays								
Marine mammals								
b. Gear measure								
c. VME indicator								
d. VME thresholds								
e. Encounters								
f. Move-on rules								
g. VME closures								
h. Spatial and temporal measures								
i. Impact assessments								
j. Climate change								

¹ The SPRFMO Convention did not enter into force until 2012, and so the measures noted here are the earliest measures available, from 2013.

² The NPFC Convention did not enter into force until 2015, so the earliest measures considered are the interim measures pre-2015 (the same measures apply to 2016).

³ The SIOFA Convention entered into force in 2012, but did not hold its first Scientific Committee meeting until March 2016. The measures reflected here are for 2016.

publication of the FAO Deep-sea Fisheries Guidelines [34–36], UNGA reviews²¹ have noted progress to address provisions of that resolution [58].

In the case of RFBs, responses commenced with the updating or replacing of their constitutive instruments, and in regions where no RFMO/As existed, three have entered into force since 2012 [112]. Once their mandates were appropriately expanded, RFBs have incorporated directed management rules for species and habitats of particular conservation concern into their work programs [30,75,127].²²

The measurement and analysis of implementation performance by RFBs²³ ([9,16,39,61,116]; RFBs also publish performance assessments on their websites) shows that change generally is incremental and often slow with improvements affected by available resources and capacity within RFBs, the population and habitat properties of the stocks and areas impacted and the level of compliance with decisions and agreements [105]. There have been a number of publications documenting actions and assessments of achievements of RFBs and similar arrangements (RFMO/As) in implementing measures for the conservation of threatened species and vulnerable ecosystems (see Table 2, also see Table 1 in [89]).

The effectiveness of bycatch [104] and habitat provisions' has been questioned [1,11,61,101], but improvements are being made now that many of the factors that impede change are now better understood [82]. A recent assessment of the level of uptake across the largest tuna

fisheries management organizations, using an ecological model as a basis for sustainability thresholds for target species, bycatch species, ecosystem properties, trophic relationships and habitats, concluded that organizations were half way towards their overall goals [75]. Measures that incorporate biodiversity considerations into management continue to spread across RFBs (Table 2), as RFBs give these issues increasing profile [10].

The above sections illustrate that fisheries-directed agreements are incorporating explicit benchmarks for the conservation of biodiversity at national, regional and global scales. These reflect the commitment of the global fisheries sector to address ecosystem and biodiversity considerations in fisheries more decisively, recognizing that strengthening of effort is still needed in communication, research, EAF planning, compliance, capacity-building, data collection and external assessment of fishery related impacts. On-going requirements of this kind are likely to be a “work in progress” for “some time to come” [16]. However, States and RFBs are documenting their performance reviews in transparent ways to facilitate the measurement of progress (Canada²⁴; Norway²⁵; USA,²⁶; [14,15,70,73,93]).

Looking ahead and recognizing that the track record for the implementation and monitoring of effectiveness for both fisheries [11,39,62] and conservation sectors [20,56,81,97,131] remains patchy, the authors highlight how such processes are and can be facilitated by ongoing convergence between fisheries and environmental sector governance, noting the major overlap between the goals promoted by the CCRF and the outcomes sought from Target 6 (see also CBD Article 14).

²¹ http://www.un.org/depts/los/reference_files/Bottom_Fishing_Advance_and_unedited_reporting_Material.pdf. Also see summary of important achievements since the adoption of the UNGA resolutions: page 4–5.

²² Inter-American Tropical Tuna Commission (IATTC) and the Northwest Atlantic Fisheries Organization (NAFO), the Indian Ocean Tuna Commission (IOTC) and the International Commission for the Conservation of Atlantic Tunas (ICCAT).

²³ Indicators to assess the performance of regional fishery bodies. See www.fao.org/docrep/meeting/003/x9378e.htm. The body of published performance assessments or evaluations of RFMOs includes technical reports, white papers and peer-reviewed literature, with both narrow and broad scope – see [116].

²⁴ <http://www.dfo-mpo.gc.ca/fm-gp/sustainable-durable/index-eng.htm>.

²⁵ <http://www.skrettingguidelines.com/readimage.aspx?asset=3701>.

²⁶ http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/.

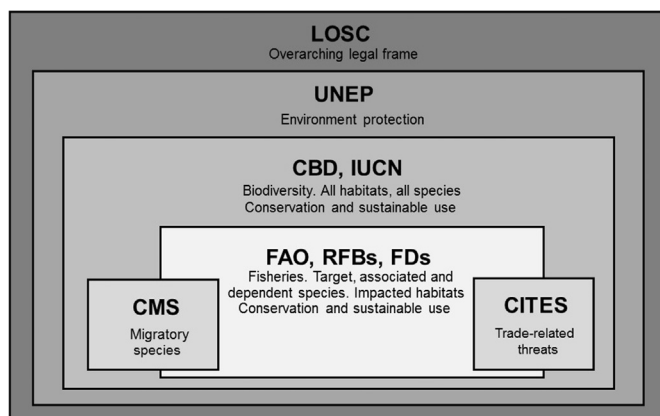


Fig. 1. Overview of main areas of activity for FAO, RFBs and Fishery Departments, CMS, CITES, CBD, IUCN, UNEP and the LOSC. All have overlapping and complementary species mandates on sustainable utilization and conservation of biodiversity. This diagram does not show the sizes of areas to scale.

5. Collaboration between fisheries sector and environment sector governance

With regard to the mandates for the environmental conservation of species and habitats, a number of organizations, conventions and agreements have recognised roles; IUCN, UNEP, CITES, the CMS, the Ramsar Convention (wetlands) and the World Heritage Convention (see Table 1 in [127]). Historically, CBD and these other international institutions that predominantly have a strategic interest in both conservation *and* sustainable use have increasingly worked with FAO (and FAO-related institutions) to strengthen actions on addressing biodiversity considerations in fisheries, and to some extent, to give due recognition to fisheries' interests (and sustainable use) across their institutions.

Article 5 of CBD focusses on cooperation and although it does not explicitly refer to the regional level, the 2010 Strategic Plan for Biodiversity 2011–2020 and the Aichi Biodiversity Targets endorsed at Rio +20, recognizes the need for such regional cross-sectoral planning and implementation of collaborative targets and strategies. The overlapping scope of interests of some of these IGOs and ENGOs (Fig. 1) is reflected in increasing convergence between fisheries and environment sector initiatives, in order to further incorporate biodiversity considerations into fisheries and broaden the range of tools available through environmental governance agencies to improve sustainable practices in fisheries.

In order to formalize these collaborative approaches, FAO and CITES signed a Memorandum of Understanding (MOU) in 2006 [63,85,108,132], while FAO and IUCN are currently in the process of formulating an MOU and established an ad-hoc Technical Working Group in 2016 to communicate on overlapping issues of interest in relation to species and fishery characterization.²⁷ While FAO and CBD do not yet have a formal agreement on cooperation in fisheries, they are part of a multi-agency Memorandum of Cooperation on the CBD Strategic Plan for Biodiversity 2011–2020 and the achievement of the Aichi Targets, and collaborate on numerous joint projects, some of which are focussed on measuring and reporting on biodiversity considerations in fisheries (e.g. Aichi Target 6 reporting, [44]). Most recently, CBD Parties invited FAO to continue working with the CBD Secretariat (SCBD) to refine advice on both the list of available indicators and methods to support the reporting processes of countries for Target 6, in one case collaborating over the adaptation of the FAO CCRF questionnaire, to reflect the requirements of Aichi Target 6 more effectively.²⁸

5.1. Strengthening consideration of biodiversity in relation to habitats

Regarding joint progress in conservation and management across marine habitats, there are a number of examples that illustrate large scale processes of biodiversity being incorporated into sectoral management on ecosystem scales, including collaboration between FAO and UNEP on the application of the ecosystem approach. For example, the UNDP²⁹ and GEF³⁰ have provided opportunities for inter-institution and cross-sectoral interactions across LMEs in Latin America and the Caribbean [124]. In 1974 UNEP, as a United Nations focal point for environmental action and coordination, initiated its Regional Seas Program (RSP) and the Regional Seas Organizations (RSOs; [127]). Across regional oceans governance mechanisms, there are increasing coordination between GEF Large Marine Ecosystem (LME³¹) projects for RSOs and fishery sector bodies. For example in the West, Central and Southern African Region, the 2012 Decision of the Abidjan Convention Contracting Parties to work together with fishery sector organizations on areas of mutual concern encouraged such cooperation [127]. To promote such coherence and integration, the CBD has been instrumental in establishing the Sustainable Ocean Initiative (SOI) that has the objective of increasing such cross-cooperation among RFBs and Regional Seas Organizations (RSOs). This initiative has the support of both CBD Parties and FAO's Members.

RSOs and RFBs are significant inter-governmental institutions, both with evolving international policies that increasingly overlap in ways that facilitates increased cooperation across issues of common interest. The historical RSO focus on the reduction or removal of pressures (pollution) across more restricted mandates (within EEZs and national environment ministries), is expanding to also encompass biodiversity conservation. To date this has largely concentrated on protecting vulnerable habitats through the creation of marine protected areas [127] and on a smaller scale, goals including socio-economic development³² [111]. Both aspects of broadening mandates present opportunities for cooperation with the corresponding RFBs. For example, the North-East Atlantic Fisheries Commission (NEAFC³³) and its analogous environmental RSO (OSPAR³⁴) have worked together within their respective mandates [91] to adopt recommendations to protect and conserve biodiversity across mutually recognised vulnerable deep water marine habitats [106]. This aligns closely with other global initiatives that offer sustainable fisheries management and biodiversity conservation in the areas beyond national jurisdiction (also see FAO ABNJ programme,³⁵ with UNEP, World Bank, WWF³⁶ and Tuna RFMOs).

5.2. Strengthening consideration of biodiversity in relation to threatened species

Some vulnerable commercially exploited aquatic species are facing a confluence of pressures,³⁷ including from fisheries, that results in

²⁹ United Nations Development Program.

³⁰ Global Environment Fund.

³¹ Developed by the National Oceanic and Atmospheric Administration, LME mechanisms (project based rather than agency or organization based) aim at implementing the ecosystem approach across the marine and coastal environment. LMEs have regional steering committees - ad hoc partnerships that include governments, UN and donor agencies, as well as the Regional Seas programs and, in some cases, RFBs to ensure cross-sectoral coordination at the domestic level. Examples where biodiversity considerations are furthered include i) Management of the Canary Current Large Marine Ecosystem, ii) Benguela Current large marine ecosystem project.

³² Protocol on Integrated Coastal Zone Management (ICZM) in the Mediterranean, Madrid, 21 January 2008.

³³ <https://www.neafc.org/>.

³⁴ The Convention for the Protection of the Marine Environment of the North-East Atlantic (<http://www.ospar.org/>).

³⁵ Global sustainable fisheries management and biodiversity conservation in the Areas Beyond National Jurisdiction Program (<http://www.commonoceans.org/about/program-structure-goals/en/>).

³⁶ World Wildlife Fund.

²⁷ FAO COFI 32 decisions: Agenda Item 10-1 (138).

²⁸ CBD/COP/DEC/XIII/28, para 11.

compounded impacts to these living resources and their enabling environments [40,41]. These impacts have resulted in some species and stocks, meeting criteria for designation as ‘threatened’ species, affording them of greater protections under national regional and international agreements [41].

Historically fisheries and environment agency relationships were often adversarial in this area, in fisheries circles driven by a perception that preservationist interests lacking expertise in fisheries were entering the functional and spatial responsibility of established fishery authorities [85], while environmental interests believed profits would be prioritised by the fisheries sector.

Initially, largely unilaterally many national fisheries authorities and RFBs adopted legally binding or voluntary measures requiring actions to avoid vulnerable species groups, including elasmobranchs, sea turtles, marine mammals and seabirds [60,122]. However, more recently, sectoral institutions have made some effort to achieve greater coherence, firstly on approaches to agree on characterization of threatened species under binding and non-binding arrangements (e.g. CITES,³⁸ CMS³⁹ and IUCN⁴⁰ listing processes), and secondly, by ramping up collaboration on implementation of processes to support threatened species management and trade (where trade can be shown to be legal and non-detrimental to the sustainability of the species).

Coherence in listings process determinations, between COFI and CITES has been improving in the last decade,⁴¹ as are subsequent inter-sectoral decisions and actions on trade in listed species: this includes joint sharing of funds for country support programs [126]; national and regional decision support documentation for listed species (CITES, IUCN and FAO, see [59,95,114,115]) and development of IPOAs for species groups like sharks [45]. Such activities are assisted by joint FAO-CITES support for national authorities in species identification across the value chain to improve country records,⁴² and collaborative assessments and communication of country responses to threatened species listing under CITES [48].⁴³

Today, species listed under environment-led initiatives are generally given elevated levels of management and conservation action by both the fishery and environment sector [29], although there is still some disagreement on the effectiveness and impacts of various interventions [18,46]. Improved inter sectoral and inter agency cooperation relies on communication, which fundamentally comes through the building of trusted relationships. These have been enabled by CBD and CITES employing dedicated marine staff (from 2015 CITES, earlier in CBD), and the IUCN initiating in 2008 a ‘fisheries expert group’ (IUCN/CEM/FEG). In the case of FAO, there is a biodiversity focal point to coordinate collaborative efforts across its Fisheries and Aquaculture Department.

Fishery and conservation governance streams also collaborate to improve biodiversity outcomes for non-commercial species impacted by fisheries. For example, FAO and RFBs, through the FAO Best Practice Technical Guidelines for International Plan of Action-Seabirds [28,34],

³⁷ Changes in marine environments (pollution and climate change) and markets (demand from a growing and more affluent consumer base).

³⁸ Criteria for amendment of Appendices I and II <https://cites.org/eng/res/09/09-24R16.php>. <http://checklist.cites.org/#/en>.

³⁹ The Convention on the Conservation of Migratory Species of Wild Animals, e.g. Memorandum of Understanding on Conservation of Migratory Sharks (<http://www.cms.int/sharks/en>), listing criteria <http://www.cms.int/sharks/en/document/cms-listing-criteria>.

⁴⁰ This includes IUCN's RL and developments to look at changes in RL characterisations across clades through time, i.e. the Red List Index (RLI). <http://www.iucnredlist.org/technical-documents/categories-and-criteria>.

⁴¹ FAO COFI 32 decisions: Agenda Item 10–1 (71:136 & 138). COFI FT 69 decisions: COFI: FT/XVI (para 50, 52, 54 & 60). CITES decisions: SC69 Sum. 7 (Rev. 1) (30/11/17), para 71.1.

⁴² <http://www.fao.org/fishery/fishfinder/publications/en>.

⁴³ <http://www.fao.org/asiapacific/news/detail-events/en/c/411644/>. CBD CITES and FAO collaborative Side Events at the 2017 Oceans Conference, CBD CoP13 and SBSTTA 21.

have, in collaboration with seabird conservation interests (BirdLife International [BLI] Global Seabird Programme) implemented collaborative action to conserve vulnerable seabird species [75,125]. In another example, the RSO and mandated fishery body, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), has worked in collaboration with BLI to significantly reduce albatross bycatch, resulting in a decrease of up to ca. 67,000 fishery/bird interactions yr⁻¹ [3].

6. Coherence, coevolution and mainstreaming

The evidence summarized above, shows that fisheries management has a long history of addressing biodiversity concerns as part of the sustainable development agenda. Efforts commenced even before the term ‘biodiversity’ was in general use, through attempts to keep fisheries sustainable by limiting their collateral impact on the ecosystem. The efforts, initially weak, have continually increased in comprehensiveness and coherence of policy, and intensity and cooperation in practical implementation, particularly in the last two decades. This has proceeded, despite both sectors having limited access to resources in order to implement their mandates and such collaborations [25,126], and this is further complicated by the need for the distinct sectoral ministries of cooperating states to facilitate said cooperation [127]. Nevertheless, in spite of such constraints, collaborations in the implementation of both the fishery- and environment-sector policies and practices are increasing [53]; some examples of this increased collaboration are reflected in Section 5.

Further strengthening cross sectoral implementation can and is being achieved through increasing communication, and more transparent measurement of the effectiveness of interventions across both environment and fisheries governance streams. This coherence of implementation is needed for at least three reasons [67,123]:

- As the development of appropriate thresholds and reference points for biodiversity conservation lies in the multidimensionality of ecosystem dynamics;
- The development of appropriate control rules (as the benchmarks are approached), must take account of the multiplicity of pressures impacting ecosystems, with no assurance that responses of an ecosystem to different pressures will be similar; and
- The difficulties of partitioning and measuring the performance of singular pressures and corresponding responses among the multitude of policy drivers.

This development and on-going delivery of biodiversity mainstreaming through a co-evolution of policy and action between fisheries and environment sectors, came about and will continue because of a number of drivers and supporting factors, including:

- A growing recognition, within the fishery arena, that sustainability and the rebuilding of resources both require a much greater understanding and recognition of inter-relations between: (i) species, e.g. through the food chain and in meta-populations; (ii) fisheries, e.g. through bycatch; (iii) fisheries and habitats, e.g. vulnerable marine ecosystems; (iv) fisheries and their environment, e.g. natural oscillations, climate change and degradation by other sectors;
- A growing community recognition of the range and complexity of interactivity within social-ecological systems. The importance of these interactions across all sectors is becoming better understood, valued and more generally accepted [87];
- Cross-sectoral agreement that biodiversity is facing a confluence of human pressures which, if not addressed, will impact negatively upon the structure, function and services provided by biodiversity to all economic sectors, with implications for human health, food-security and livelihoods;

- A growing awareness that people are an integral part of our environment, and that conservation approaches without or against humans are likely to fail [23,74,76,84];
- Global agreements documenting binding and non-binding instructions for management and conservation of fisheries and biodiversity (e.g. UNCLOS, UNCED, CCRF, CBD, CITES), which promote sustainable use as part of, and the condition for, conservation;
- Growing political support encouraging collaborative partnerships in the mainstreaming of biodiversity in fisheries – from UNGA, UN agencies and Programs and Regional institutions, and also, national fisheries and environmental offices – to encourage integrated action on these difficult questions, which cross-cuts the triple bottom line of sustainable development; and
- Growing consumer demand for sustainable fisheries, with market processes placing greater requirements on the fishery trade and fisheries' social licence to operate.

Nevertheless, some tensions on areas of policy development need to be acknowledged. For example, although data shows that global marine capture production has been stable since the mid-1990s, the share of fish stocks within biologically sustainable levels has exhibited a downward trend to circa 68% [40]. This result does not negate or undermine the core message of the paper, as the data masks advances some countries are making in fisheries rebuilding [134,135], while underscoring that on-going over-exploitation of some fish stocks, especially in developing countries, remains a significant challenge requiring both political will and capacity for science and management. Shifting the focus of this discussion to provide guidance for the full scope of biodiversity also requires greater political will and further development of understanding of the various elements of biodiversity (e.g. intraspecific variation, genetic pools, species assemblages, critical habitats). This will help ensure it is well addressed across the full range of sectoral activity, including fisheries [17,22,87]. More discussion is needed around trade-off decisions considering conservation and food security: this relates to livelihood options, or the differential perception of risk that translates into disparities in criteria design, interpretation, decision making [24,57,83,107] and the methods employed to prioritize or conserve biodiversity. To assist the on-going development of programs to ensure the UN Sustainable Development Goals are achieved, many of these new areas of understanding and/or old tensions will need to be confronted, any number of which could provide either the opportunity for further collaboration and resolution, or a battleground for confrontation.

7. Discussion

Acceptance that mainstreaming of biodiversity considerations in fisheries is occurring will be acknowledged when:

- i) the fishery sector formally accepts accountability for the full footprint of its activities on biodiversity, taking such impacts into account in the design of its strategic policy and planning, management measures, and practices;
- ii) all the components of Aichi Target 6, are part of standard guidance from FAO to national and regional fisheries management authorities and are being implemented.

The evidence presented in this paper supports the argument that both criteria are being progressively met, and that states are mainstreaming biodiversity into their legal frameworks, policies and management measures at speeds reflective of their different capacities and in relation to the range of socioeconomic situations that can influence their political priorities.

In Section 3 the components of Aichi Target 6 for fisheries lay out the norms for taking biodiversity sufficiently into account in fisheries management. Section 4 and the information Tables 1, 2 document that

for each component of Target 6, FAO, RFBS and States have developed policies intended to deliver outcomes consistent with the norms being set. Section 5 documents how efforts to implement these policies have been progressing, and despite variation in progress, these efforts are increasing the cooperation between fisheries and environmental agencies. Thus although the term “mainstreaming biodiversity” only first occurs in a COFI Report in 2016 [42], in fact the policy development and implementation efforts to achieve such an aim have been part of the evolving agenda of fisheries management for at least three decades. With all the components of Target 6 being addressed in this evolving agenda, it can be concluded that fisheries is already succeeding in mainstreaming biodiversity into fisheries policy and management. As the existing policies are implemented and coherence and cooperation continue, the outcomes meeting the Target 6 norms should be realized.

In spite of early enmity and conflict, it has been shown in this paper, that over time, there has been a significant shift to initiate more joint effort, pursuing parallel courses into sustainability and greater responsibility in the use of natural resources and biodiversity; this has resulted in increased biodiversity mainstreaming, and a convergence in governance principles and approaches between jurisdictions [53]. The resulting co-evolution and coherence has not subordinated or undermined the mandate and competencies of either sector, partly because fishery and conservation agencies have followed their own core objectives, independently, and partly because of progressively more active collaboration since UNCED.

In cases where there are implementation failures or progress is slow, sectors need to embrace collaboration and a strengthening of coherence and collaboration between fisheries management and biodiversity conservation bodies, since parallel but uncoordinated and independent efforts are likely to delay delivery of mainstreaming, and result in inefficient use of available but limited resources. In new areas of negotiation, for example, any new international, legally-binding instrument on marine biological diversity beyond areas of national jurisdiction (BBNJ), UNGA negotiations will only yield increased management and conservation of biodiversity through collaborative action across sectoral interests.

In summary, it is recognised that it is difficult to measure - and report globally - on the level of effectiveness of implementing management approaches that consider biodiversity. However contrary to earlier finding by Garcia and Newton suggesting that, “*the scientific understanding as well as the legal and institutional frameworks that would be adequate for ecosystem management, are simply inadequate*” [51], the information presented in this paper shows that, 20 years later, the architecture for the mainstreaming of biodiversity in fisheries is now more complete across international, regional and most national frameworks, with cross-sectoral collaboration on policy and actions having advanced, and increasing in number and scope.

The following is one of the key provisions in the Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem:

“It is important to strengthen, improve, and where appropriate establish, regional and international fisheries management organizations and incorporate in their work ecosystem considerations and improve cooperation between those bodies and regional bodies in charge of managing and conserving the marine environment”.

This emphasis on the cross-sectoral institutional aspect,⁴⁴ which must be strengthened and improved in order to successfully incorporate ecosystem considerations into fisheries management, does reveal significant progress. It is therefore argued that 20 years later, the shift from conventional to EAF fisheries management has gained momentum, with the principles and rationales being integrated into fishery administrations – despite more work still needing to be done across the full range of RFBs and fishing communities, particularly small scale

⁴⁴ Also seen in Principle 7 of UNCED.

fisheries in developing countries [77,127].

Contrary to the abiding cliché that biodiversity and fisheries conservation are at odds, mainstreaming has benefitted from bridge-building between a wide range of sectoral actors and a convergence of actions. However, although this paper argues that there has been progressive improvement in how biodiversity considerations are and have been mainstreamed into fisheries, consideration of the mainstreaming of key aspects of fisheries is also required in the design and delivery of conservation focussed interventions: in particular, better consideration of food security and livelihoods issues of vulnerable communities and the inclusion of these people in the planning and provision of these initiatives. Full and reciprocal mainstreaming between fisheries and biodiversity, requires agreed targets for the sustainable use of biodiversity that reflects the economic and social concerns of the human populations that depend on fisheries.⁴⁵

By way of conclusion, this paper argues that as implementation progresses, so the outcomes of current fisheries management approach those called for in Target 6. Thus, in its own right, and by pursuing sustainable development through an ecosystem approach, the global fishery sector has indeed managed to mainstream many biodiversity considerations into fisheries policies and governance controls. With biodiversity being effectively mainstreamed into fisheries policy, and remaining gaps being identified and worked on, a significant part of the fisheries and biodiversity conservation communities which had not historically engaged with one another – either as a result of distrust, or believing they had different focuses – have progressed to an active identification of common ground and interests, as well as better alignment of short- and long-term goals.

To continue the implementation of this biodiversity mainstreaming process, requires “all hands on deck”, in order to strengthen the collaborative and integrated partnerships that offer a future in which healthy and productive natural systems deliver sustainable services for people and the environment.

Acknowledgements

In the case of the author employed by FAO, the idea for the collaborative paper was facilitated by travel funded by the FAO Regular Programme with kind assistance from the Government of Japan. The views expressed in this paper are the authors' own opinions, and do not necessarily reflect those of the FAO or any of its Members. The authors also thank the Executive Secretary of IOTC, Mr Chris O'Brien and Ms Jessica Fuller and Ms Merete Tandstad from FAO for permission to use some unpublished research that presents an updated review of tuna RFMO consideration of biodiversity, presented in this paper in Table 2. This work is supported as part of a GEF-funded project, "Sustainable fisheries management and biodiversity conservation of deep-sea living marine resources and ecosystems in the ABNJ".

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