

How are appropriate performance levels developed for MSC certification? A case study assessing shark finning

A.N. Gutteridge^{a,*}, A. Bräutigam^b, K. Dewar^a, R.J.C. Currey^{a,c}

^a Marine Stewardship Council, Marine House, 1 Snow Hill, London EC1A 2DH, United Kingdom

^b Washington, DC, USA

^c Centre for Ecology & Conservation, University of Exeter, Penryn Campus, Cornwall TR10 9FE, UK

ARTICLE INFO

Keywords:

Shark finning
Sharks
Marine Stewardship Council (MSC)
Best practice
Fisheries
Sustainability

ABSTRACT

Marine Stewardship Council (MSC) certification is based on an assessment of a fishery's performance against three levels within the MSC Fisheries Standard: 'minimum acceptable', 'best practice' and 'state-of-the-art'. Determining the criteria that define these performance levels in the MSC Fisheries Standard is a challenging task. This is due to factors including the constant evolution of management practices that are used as benchmarks for each performance level, the broad nature of the MSC Fisheries Standard which must be applicable to all fisheries regardless of scale or intensity, and differing perspectives of stakeholders. Periodic review and updating the MSC Fisheries Standard ensure that certification keeps pace with global fisheries management. An area where the performance levels within the MSC Fisheries Standard were suspected to have lagged global management was in relation to shark finning. This study provides a global summary of management measures to minimise shark finning, an overview of information used to determine appropriate performance levels to assess shark finning, and the decision processes that led to changes in the revised MSC Fisheries Standard. The key changes are 1) a fins naturally attached (FNA) measure being required for all MSC certified fisheries that retain sharks, as FNA is now considered a global 'minimum acceptable' performance level, and 2) an MSC default definition for 'sharks' being Selachimorpha and Rhinoprismiformes. In combination with other aspects of the MSC Fisheries Standard, the revised requirements represent a significant step forward to ensuring that shark finning does not occur in MSC certified fisheries.

1. Introduction

Since its inception in 1999, the MSC programme has become the most well-known and widely applied sustainability certification scheme for global fisheries [1,2]. MSC certification is a market-based approach to demonstrate sustainability, whereby seafood products from certified fisheries are distinguished to consumers using the MSC eco-label [3]. This, in turn, is posited to influence consumer trends to purchase products carrying the eco-label, thereby increasing the demand for certified products, incentivising more fisheries to seek certification [4].

Like other certification schemes, the MSC programme involves a third-party assessment against a rigorous set of performance indicators within the MSC Fisheries Standard (herein referred to as the Standard)

[3,5].¹ Embedded within these performance indicators are three performance levels, termed scoring guideposts, that increase in relation to how well a fishery scores against specific criteria. These three levels, in ascending order of performance, are a 'minimum acceptable', 'best-practice' and 'state-of-the-art' level.² To achieve MSC certification, fisheries must i) at least achieve the 'minimum acceptable' level across all performance indicators, ii) reach or maintain the 'best practice' level during the five-year certification cycle and iii) achieve an average of 'best practice' across the three MSC Principles that contain the performance indicators [5].

Though they are assessed throughout the Standard, defining appropriate performance levels is a balance between maintaining credibility and rigor, with accessibility and uptake [1,6]. Adding to the challenge, is

* Corresponding author.

E-mail address: adrian.gutteridge@msc.org (A.N. Gutteridge).

¹ The MSC Fisheries Standard v2.01 (2018) assessed 28 performance indicators across three Principles. Principle 1 is related to the state of the target stock, Principle 2 is related to ecosystem impacts and Principle 3 is related to the management arrangements in place for the fishery.

² The 'minimum acceptable' level is assessed at Scoring Guidepost (SG) 60, 'best practice' at SG80 and 'state of the art' at SG100.

that performance levels are a ‘moving target’ [7] and the perspectives for each may differ among stakeholder groups [8,9]. To determine if MSC performance levels are appropriate, it is necessary to understand the approaches and underlying rationales that have been developed to address specific fisheries management issues and the effective measures that have been implemented to resolve them [9].

Every 5 years, the Standard is reviewed and updated as part of the Fisheries Standard Review (FSR) (refer to [Supplementary Information](#) for additional information). Conducting a process such as the FSR is not only an obligation for standard setting organisations, but it is paramount in ensuring that the criteria underpinning each performance level remain relevant and keep pace with evolving management practices. An area of the previous Standard (i.e., the Standard v2.01) where the performance levels were suspected to not adequately reflect management advances, was the assessment of shark finning.

Shark finning is prohibited in MSC-certified fisheries and is defined in the Standard as the practice of removing any of the fins of a shark (including the tail) while at sea and discarding the remainder of the shark at sea [10]. International market demand for shark fins – for use in the Chinese celebratory dish, shark fin soup – has been a major driver of shark fishing and subsequent overfishing [11]. Recognising this, the United Nations Food and Agriculture Organization (FAO) International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks) discouraged shark finning in favour of, among other things, full utilisation and minimization of waste [12]. Since its release, many FAO member countries have prohibited shark finning [13,14]. International market demand for shark fins and other products (e.g., meat, cartilage, liver-oil [15,16], coupled with the global expansion of fisheries (which capture and kill many sharks incidentally) and trade in fisheries products, has exerted overfishing pressure on sharks. Overfishing is the single major cause of declines in shark populations and an increased risk of extinction for this distinctive group of fishes [11,16]. It is important to note that shark fins do not always derive from shark finning, as shark fins can also be from animals that have not been finned and discarded, but rather, processed from a whole animal utilised according to the principles of the FAO IPOA-Sharks [12]. However, persistent market demand for shark fins remains an incentive for shark finning.

Where shark finning has been prohibited, the two main compliance measures that management agencies and fishing jurisdictions have implemented are a fins-to-carcass ratio (FCR) or fins naturally attached regulation (FNA). FCR regulations allow the fins of a shark to be removed at sea, with a minimum specified ratio, usually at 5% of fins to carcass [13,17]. Shortcomings in the use of FCR, however, have been identified. First, the ratios or mass conversions vary significantly depending on the processing technique, leading to inaccurate estimates [18]. Second, FCR can change based on the species or age-class of the species [14]. Third, allowing processing at sea can lead to high grading, whereby more valuable fins are retained alongside non-corresponding carcasses [19]. Lastly, identification of species and collection of other data necessary for management decision-making is much more difficult once the fins have been removed [13,20]. Unlike FCR, an FNA regulation prohibits the removal of fins at sea, prior to landing. FNA is considered more effective as “the only fail-safe, most reliable, least expensive means to prevent finning and measure compliance” [14].

The previous requirements in the Standard v2.01 [10] were established to deliver a level of assurance that shark finning was not occurring within MSC certified fisheries. Shark finning was assessed across the three performance levels of ‘minimum acceptable’, ‘best practice’ to ‘state-of-the-art’ [10,21]. Performance levels were met based on the types of policy, measures and regulations in place (e.g., FCR and FNA), the documentation related to the destination of all shark body parts and the levels of external validation of the fishery, typically observer coverage levels. Fins naturally attached (FNA) was acknowledged to be ‘best practice’. However, alternative measures, such as FCR, were also permitted at this performance level, provided relevant levels of external

validation were in place (refer to [Supplementary Information](#) for the shark finning requirements in the Standard v2.01). Further, if rare and isolated incidents of shark finning were detected through high levels of external validation (e.g., observer coverage) the fishery could remain certified if it could demonstrate that finning was not systematic and appropriate sanctions were administered. In parallel to the scoring requirements, the MSC Fisheries Certification Process requirements were updated in 2020, such that if an entity had been convicted of shark finning, it could not be part of an MSC certificate and was ineligible from certification for two years from the date of conviction [22]. This was further clarified that if any verifiable evidence of shark finning was identified, the offending vessel had to be removed from the certificate, otherwise the MSC certified fishery would be suspended.

Three main issues were identified with respect to the application of the shark finning requirements in the Standard v2.01. First, allowing alternative measures to FNA at the ‘best-practice’ level was likely out of step with progress in the adoption and implementation of FNA by fisheries management agencies. Second, the MSC policy prohibiting shark finning in MSC certified fisheries essentially made shark finning a zero-tolerance issue, which was not adequately reflected in the requirements. Third, the application of the requirements across global fisheries was perceived to create an uneven playing field, particularly with regards to the monitoring, control and surveillance (MCS) needed to detect or prevent the occurrence of shark finning. Together, these three main issues led to the MSC shark finning requirements being reviewed as part of the FSR.

This paper provides an overview of how the revised requirements for assessing shark finning were developed during the FSR. We present a compendium of shark finning measures and definitions for the term ‘shark’, up to 2020 across shark-relevant Regional Fisheries Management Organisations (RFMOs) and the fishing entities (countries, territories, and other political entities) that are considered to catch the most sharks globally (following Fowler et al., 2021 [23]). We frame these measures and definitions against the performance levels of the MSC requirements and demonstrate how gathering perspectives from diverse stakeholders and reviewing multiple sources of information, including through a targeted review, is key to determining appropriate performance levels within the MSC requirements.

2. Methods

Two datasets informed the revised requirements around shark finning that were developed and adopted into the revised Standard (i.e., MSC Fisheries Standard v3.0 [24]) through the FSR: i) a global review of shark finning measures, i.e., legal requirements; and ii) the results of public consultations.

2.1. Global review of shark finning measures

A consultancy report was commissioned by the MSC to review the existence and evolution of shark finning measures adopted by a selection of regional and national fisheries management agencies up to mid-2020 [25]. The focus of the report included the uptake of FNA as a compliance mechanism and the taxonomic coverage (i.e., definition of ‘shark’) in shark finning measures. The results of the Bräutigam (2020) [25] consultancy report form the basis of the information related to shark finning measures and definitions in the current study. At least 143 countries, areas, territories and entities report shark catches to FAO [26]. To provide a representative sample of shark finning measures amongst these, the review focused on 43 fishing entities. Forty of these were documented in FAO FishStat data (<https://www.fao.org/fishery/en/collection/capture?lang=en>) for 2007–2018 as having caught the most sharks, more than 80% of reported global catches [23], while three were suspected – based on their known fishing operations rather than the accuracy of their shark catch reporting to FAO – to be important shark catching entities (China, Myanmar and Việt Nam). These 43

fishing entities incorporated all regions of the world, with many fishing across numerous jurisdictions, including the high seas. In addition, the shark finning measures (i.e., Conservation and Management Measures-CMMs) adopted by 15 shark-relevant Regional Fisheries Management Organisations (RFMOs) were reviewed.

Similarly, for national jurisdictions, the focus was on legally enforceable shark finning laws and regulations adopted by national governments. The main source of information related to legal measures for sharks were the FAO Shark Measures Database (<https://www.fao.org/ipoa-sharks/database-of-measures/en/>) and FAOLEX (<https://www.fao.org/faolex/en/>), FAO's online fisheries law database. Other sources of information included the websites of national fisheries agencies, as these commonly include links to relevant information, such as specific legal instruments or legal databases. Where accessible, national shark finning regulations implemented through fishing licenses, permits or other Authorisations to Fish, or fisheries management plans were also included.

Binding RFMO measures were accessed via RFMO websites. A database of shark-finning measures, based on and incorporating primary-source documents (legal texts), maintained by A. Bräutigam was also used. Finally, national and regional Plans of Action developed under the FAO IPOA-Sharks were reviewed for specific information on shark finning measures adopted or under discussion; these could then be confirmed through additional research.

In addition to primary source documentation outlined above, a questionnaire was circulated to a selection of fisheries management agencies and RFMO Secretariats. The questionnaire focussed on gathering information on the current measures in place with respect to finning bans, including FNA and the definition of sharks in their jurisdiction.

2.1.1. Limitations and caveats

For many political jurisdictions, legal measures governing shark finning were not locatable or verifiable. This was primarily due to documentation not being in the public domain or only accessible in a language other than English, French, Spanish, or Portuguese. Thus, there may be shark finning measures in place for some fishing entities that are not reflected in this study. There is also variability in how jurisdictions regulate shark finning and, thus, to which fisheries and fishing fleets their shark finning measures, including FCR or FNA, apply. For example, EU shark finning rules, which include a FNA measure, apply to all EU vessels wherever they fish, yet the shark finning bans adopted in several of the other fishing entities reviewed, apply to national waters only and not necessarily to nationally licensed fishing vessels operating outside of national waters. Importantly, many shark-fishing entities are members of RFMOs and, thus, are obligated to implement RFMO shark finning rules, which, by definition, apply to certain fleets, vessel sizes, and geographical areas, as well, in some instances, to specific species or species groups. For some of these fishing entities, the RFMO measures may represent the full extent of the shark finning regulations applying to their fishing operations, while, for others, the RFMO measures may be a subset of a much broader scope of shark finning regulations with which all or some of their fishing fleets must comply. This aspect of the study focused on national finning bans and associated compliance measures (FCR or FNA) adopted in addition to RFMO measures. In some instances, it was difficult to determine whether the national measures were limited or supplemental to RFMO obligations. It should be noted that this study

did not assess compliance with shark finning measures.

2.2. Public consultations

Public consultations were conducted in mid-2021 and early 2022 by the MSC as part of the FSR. Both public consultations related to proposed changes associated with the shark finning requirements. Proposals focussed on shark finning measures and the information needed to demonstrate adherence to those measures. Note, the consideration of information needed to demonstrate adherence to shark finning measures related to a separate project as part of the FSR, termed the Evidence Requirements Framework (refer to [Supplementary Information](#) for additional information). Each public consultation involved stakeholders responding to statements (refer to [Supplementary Information](#) for each statement) about whether the proposed changes would be i) 'effective'; the extent to which the change is deemed likely to be successful in producing the desired results and resolving the issue(s) originally identified, ii) 'feasible'; the practicality of a proposed change and the extent to which a change is likely to be successfully implemented by fisheries within a given setting and time period, and iii) 'acceptable'; the extent that the change is considered tolerable or allowable, such that the MSC program is perceived as credible and legitimate by stakeholders. 'Effective', 'feasible' and 'acceptable' are herein referred to as 'impact types'. Likert scores from 1 to 5 were provided by participants for each statement, from; 1 – 'strongly disagree'; 2 – 'disagree'; 3 – 'neither agree nor disagree'; 4 – 'agree'; and 5 – 'strongly agree', as well as 'don't know'. Each statement allowed participants to provide reasons for the scores provided. Thematic analysis was then undertaken to identify key reasons for the responses provided and to identify trends across the responses.

The 2021 and 2022 public consultations differed in terms of the proposals put forward, as the results of the 2021 public consultation informed changes that were proposed in 2022 ([Table 1](#)). There were three main differences between them. First, in the 2021 public consultation, alternatives to FNA were permitted if the retained species was managed against reference points and their stock status was informed by a stock assessment. Alternatives to FNA included FCR, fins artificially attached (e.g., using ropes or wires) or fins stored in the same bag as the trunk. These alternatives to FNA were removed as an option in the 2022 public consultation.

Second, during the 2021 public consultation, the underlying information used to assess shark finning, as part of the Evidence Requirements Framework, was proposed to occur on a risk-based approach. If a fishery was 'high risk' to shark finning, they would require a higher threshold in terms of determining the accuracy of information used to assess the fishery. A 'high-risk' example was proposed to include a fishery that used alternatives to FNA. During the development of the Evidence Requirements Framework as part of the FSR, a risk-based approach to assessing information was removed.

Third, in the 2022 public consultation, if a species of shark was captured but not retained, it was proposed that the fishery could demonstrate the implementation of a non-retention measure at the 'minimum acceptable' level (i.e., individuals captured must be returned to the water with as little injury as possible and cannot be landed or retained either in whole or in part). It should be noted that the intent of 'retained' is that the animal is landed either in whole or in part, provided the fins are not removed, and reflects how MSC approaches a species

Table 1
Overview of the proposals for the 2021 and 2022 public consultations.

Year	Shark finning scored only at 'minimum acceptable' performance level	Shark finning scored explicitly for ETP species	Alternatives permitted to Fins Naturally Attached (FNA) when sharks retained	Underlying information assessed on a risk-based approach	Underlying information used only to determine FNA or non-retention in place
2021	Yes	Yes	Yes	Yes	No
2022	Yes	Yes	No	No	Yes

Table 2

Adoption of shark finning ban (FB), fin-to-carcass-ratio (FCR), or fins naturally attached (FNA) measures by 15 shark-relevant RFMOs as at May 2020. N = measure not adopted based on documentation reviewed; dates indicate year of adoption, not necessarily of entry-into-force [25].

RFMO	FB	FCR	FNA	Taxonomic coverage	Notes
Comisión Técnica Mixta del Frente Marítimo (CTMFM) - Joint Technical Commission for the Argentina/Uruguay Maritime Front	2009	N	N	In a measure that refers to “cartilaginous fishes” and “chondrichthyans, “the finning ban refers specifically to “tiburones” (sharks)	-
Convention for the Conservation of Antarctic Marine Living Aquatic Resources (CCAMLR)	N	N	N	-	Directed fishing of sharks other than for scientific research in the Convention Area was prohibited in 2006
Convention for the Conservation of Southern Bluefin Tuna (CCSBT)	N	N	N	-	Members and Cooperating Non-Members fishing for SBT in other tRFMOs required to comply with those RFMO measures
General Fisheries Commission of the Mediterranean (GFCM)	2012	N	2018	2018 CMM specifically defines “shark” as any species of Elasmobranchii and “shark fin” as <i>inter alia</i> excluding the pectoral fins of rays, “which are a constituent part of raywings”	-
Inter-American Tropical Tuna Convention (IATTC)	2005	2005	N	CMM calls for CPCs to implement the FAO-IPOA-Sharks but does not define “shark”	-
International Convention for the Conservation of Atlantic Tunas (ICCAT)	2004	2004	N	References FAO IPOA-Sharks but does not define “shark”	-
Indian Ocean Tuna Commission (IOTC)	2005	2005	2017: fresh sharks	2017 CMM references FAO IPOA-Sharks but does not define “shark”	2017: FCR frozen sharks (where FNA not required)
Northwest Atlantic Fisheries Organization (NAFO)	2005	2005	2017	FNA requirement does not reference FAO or FAO IPOA-Sharks; does not define “shark”	-
North-East Atlantic Fisheries Commission (NEAFC)	2015	N	2015	Refers to but not does not define “sharks”	-
North Pacific Fisheries Commission (NPFC)	N	N	N	-	-
Regional Commission on Fisheries (RECOFI)	N	N	N	-	-
Southeast Atlantic Fisheries Organisation (SEAFO)	2006	2006	N	In referencing FAO IPOA-Sharks, defines “sharks” as “elasmobranchs” (vs. Chondrichthyes)	-
Southern Indian Ocean Fisheries Agreement (SIOFA)	N	N	N	-	-
South Pacific Regional Fisheries Management Organization (SPRFMO)	N	N	N	-	-
Western and Central Pacific Fisheries Commission (WCPFC)	2006	2010	2019	CMM 2019–04 specifically defines “shark” as all species of Class Chondrichthyes and “finning” as removing and retaining all or some of a shark’s fins and discarding its carcass at sea (per FAO-IPOA-Sharks)	Allows 3 alternatives to FNA, including i) each carcass and its corresponding fins are stored in the same bag, ii) shark carcass is bound to the corresponding fins using rope or wire and iii) identical and unique tags are attached to the carcass and corresponding fins.

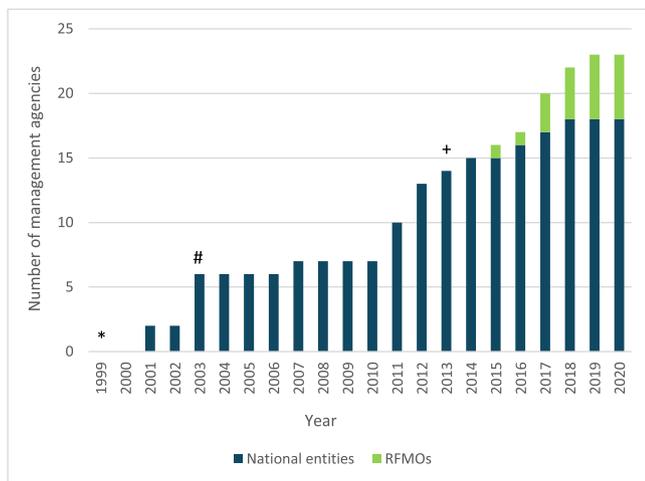


Fig. 1. Cumulative adoption of Fins Naturally Attached (FNA) for at least a portion of the fleets under the management of the 43 national fishing entities and 15 shark-relevant RFMOs from 1999 to 2020. * the year the IPOA-Sharks was released, 1999; # the year the EU implemented FNA, 2003; + the year the shark finning requirements were first incorporated into the MSC Fisheries Standard v1.3, 2013.

that is ‘landed’, being the permanent removal of the animal from the water. A non-retention measure was proposed in recognition of its uptake by RFMOs and national management agencies for certain species (e.g., mobulid rays, silky sharks, oceanic whitetip sharks, sawfishes). Non-retention also extended to the explicit or presumed rules applying for fisheries operating in a shark sanctuary, understood to mean an area where targeted shark fishing is prohibited and from which no sharks may be retained.

2.3. Defining ‘shark’

Based on the findings of the MSC-commissioned review [25], a proposed default definition for the term ‘shark’ with respect to shark finning was put forward for inclusion in the requirements during both public consultations. The proposed default definition was to include all species within the superorder Selachimorpha (true sharks, numbering c. 500 species – see Ebert *et al.* 2021 [27]) and order Rhinopristiformes (guitarfishes, sawfishes, shovelnose rays and wedgefishes, numbering c. 60 species [28]) for assessment within the shark finning requirements. This default definition was proposed because, at the inception of the FSR, a review of MSC assessments identified inconsistencies in the species being evaluated against the shark finning requirements. Such inconsistencies reflect the variability and lack of consistency in the definition of ‘shark’ by both regional and national management bodies. The default definition was proposed to standardise the species to be assessed against the MSC shark finning requirements and to include those species that are most prominent in and targeted by the shark fin trade. The proposal also included that if an MSC fishery is operating under a regulatory framework that defines the term ‘shark’ to include additional species (e.g., the full class Chondrichthyes, as per the IPOA-Sharks), these additional species should be assessed against the shark finning requirements. Although the default definition was included in both the 2021 and 2022 public consultations, only the 2021 public consultation asked explicitly for feedback on the definition.

Stakeholder perspectives were gathered about whether the default definition was ‘effective’, ‘feasible’ and ‘acceptable’. However, because the results of the public consultation were largely inconclusive, the default definition was further tested using an examination of how it related to species identified in the shark fin trade (based on Fields *et al.* 2017 [29]).

3. Results

3.1. Regional shark finning measures

Of the fifteen most shark relevant RFMOs [23], nine had adopted a ban on shark finning by mid-2020. The earliest ban was agreed by the International Commission for the Conservation of Atlantic Tunas (ICCAT) in 2004 (Table 2). Until 2015, six of the RFMO shark finning bans were subject to a 5% FCR requirement. The first FNA requirement across any RFMO was adopted in 2015 by the North-East Atlantic Fisheries Commission (NEAFC). Since then, four others have adopted a FNA regulation (Fig. 1), with two of these allowing for alternatives or exemptions under certain conditions (Table 2). Only two of these RFMOs, General Fisheries Commission of the Mediterranean (GFCM) and Western and Central Pacific Fisheries Commission (WCPFC), have defined the term ‘shark’ with regards to their finning ban. The General Fisheries Commission of the Mediterranean (GFCM) definition, however, presents difficulties in interpretation by its exclusion of ‘the pectoral fins of rays’ in the definition of ‘shark fin’ and may, in fact, inadvertently exclude from the finning ban batoids such as the Rhinopristiformes that are targeted for the shark fin trade.

3.2. National shark finning measures

Of the 43 fishing entities reviewed, 20 were confirmed to have adopted a shark finning ban beyond their RFMO obligations, with 18 having adopted a FNA requirement for at least some portion of their fishing fleets (Table 3, Fig. 1)³. Of these 18, 13 adopted FNA prior to 2013 (four of which included EU member states) the year the first shark finning requirements were released in the Standard v1.3 [21] (Fig. 1).

3.3. Definition of shark

The taxonomic coverage of shark finning measures varied widely between national jurisdictions, with very few using scientific nomenclature that would facilitate interpretation of the species concerned. Only ten of the 20 fishing entities that adopted a national finning ban define the term ‘shark’ for the purposes of the finning ban (Table 3). Of these, Australia is the only country to have adopted a finning ban that applies to all Chondrichthyes. New Zealand considers all Chondrichthyes excluding Batoidea which, thus, expressly also covers the chimaeras (at least one species of which has been recorded in the shark fin trade – see Fields *et al.*, 2017 [29]). Six refer to ‘Elasmobranchs’ (including the four EU member states operating under the EU regulation that specifically exempts ‘pectoral fins of rays’). While Mexico’s finning ban is explicit in being limited to the ‘true sharks,’ i.e., Selachimorpha, it can be inferred that other Hispanophone countries’ use of the term ‘tiburón’ (shark) or ‘recurso tiburón’ (shark resource) also applies to the true sharks (Selachimorpha), based on the definition of ‘tiburón’ and the distinction made in several of these measures between ‘tiburón’ and, for example, ‘condrictios’ (chondrichthyans) and ‘peces cartilaginosos’ (cartilaginous fishes = chondrichthyans). The US, in its implementing regulation not in its overall statute, excludes ‘skates and rays’ from the shark finning prohibitions. Only two RFMOs explicitly defined the term ‘shark,’ in relation to their finning ban, and most provided no definition at all of ‘shark’ nor indication of the species covered by their finning bans (Table 2).

In terms of how the default definition would apply against the species in the shark fin trade, Fields *et al.* (2017) identified 73 species of chondrichthyans in Hong Kong shark fin markets [29]. The default definition of Selachimorpha and Rhinopristiformes would cover 69 (95%) of these species, with the only species not covered being

³ Countries that are part of/governed by the EU were included in the count (n=4), but the EU as a stand alone entity was not.

Table 3

Adoption of a shark finning ban (FB), fin-to-carcass-ratio (FCR), or fins naturally attached (FNA) for the 40+ major global shark-fishing entities based on FAO FishStat data for 2007–2018 (see Fowler et al., 2021 [23]), and the EU, as at May 2020. ? = no information located to confirm existence of measure; N = information located but measure not adopted based on documentation reviewed; RFMO = solely implementing relevant RFMO shark finning measures. Entries with more than one date indicate revisions to finning measures. Taxonomic Coverage indicates definition of “shark” in relation to the finning measure(s). Global Rank = relative importance in terms of global shark catches based on FAO FishStat data [23]). Not Ranked = not one of Top 40 shark-fishing entities based on FAO FishStat data but suspected to be important global shark-fishing entities based on size and effort of their fishing fleet [25].

Fishing Entity	Global Rank	FB	FCR	FNA	Taxonomic Coverage	Comment
Angola	38	?	?	?	?	-
Argentina	6	2009	N	N	“tiburones” (sharks) not defined; differentiated from “condrictios” (chondrichthyans) elsewhere referred to in this measure	-
Australia	23	2000	N	2011	All Chondrichthyes. The regulation currently in force details Prohibited Ways of Processing sharks according to different taxa (e.g., sharks, angel sharks, skates, rays, chimaeras)	FB implemented gradually for different fisheries from 2000. FNA incorporated into permit conditions, then adopted into law in 2011 for all Commonwealth fisheries. FCR may apply for some fisheries under jurisdiction of individual states
Brazil	9	2012	N	2012	Any species of Elasmobranchii	Requires FNA for all landings in Brazil of national or foreign vessels
Canada	36	1994	1994	2018, 2019	“Shark” not defined, although skates must also be landed whole with pectoral fins attached	Implemented in licensing conditions over time and incorporated into Fisheries Act in 2019. FNA for skates adopted in 2019
Chile	39	2011	N	2011	“tiburones” (sharks) not defined	-
China	Not Ranked	RFMO	RFMO	RFMO	RFMO	-
Costa Rica	32	2001	2005	2001, 2008	“tiburones” (sharks) not defined	-
Ecuador	20	2007	N	2007	“recurso tiburón” (shark resource) not defined	-
European Union (EU)	See Comment	2003	2003	2003, 2013	Any species of Elasmobranchii; “shark fins” defined as any fins of sharks including caudal fins, but excluding the pectoral fins of rays, “a constituent part of ray wings”	All EU Member States are governed by EU fisheries measures adopted under the Common Fisheries Policy; these include shark-finning measures. Exemption to 2003 finning prohibition via special permits requiring FCR rescinded in 2013.
France (EU)	13	2003	2003	2003, 2013	Per EU	-
Ghana	27	N	N	N	-	-
India	3	2013	N	2013	“shark fins” not defined in <i>Policy on prohibition of ‘finning’ of Shark fins in the sea</i>	-
Indonesia	1	RFMO	RFMO	RFMO	-	-
Iran	16	?	?	?	?	-
Japan	14	RFMO	RFMO	RFMO	“sharks” not defined	-
Rep. Korea	18	RFMO	RFMO	RFMO	RFMO	-
Madagascar	29	N	N	N	-	-
Malaysia	8	N	N	N	-	-
Mexico	4	2007	N	N	“tiburones” (sharks) defined as “Selachimorpha”	-
Morocco	34	?	?	?	?	-
Myanmar	Not Ranked	N	N	N	-	-
Namibia	37	RFMO	RFMO	RFMO	RFMO	-
New Zealand	11	2014	2014	2014	Chondrichthyes excluding Batoidea.	FNA applies to most species, including spiny dogfish, which is subject to the NZ Quota Management System (QMS). Fins artificially attached (FAA) applies to blue shark, and FCR applies to the remaining seven QMS shark and chimaera species.
Nigeria	10	?	?	?	?	-
Oman	21	?	?	?	?	-
Pakistan	15	?	?	?	?	-
Peru	17	2016	N	2016	“recurso tiburón” (shark resource) not defined	-
Philippines	31	N	N	N	-	-
Portugal (EU)	12	2003	2003	2003, 2013	Per EU	-
Russian Federation	33	?	?	?	?	-
Senegal	25	N	N	N	-	-
South Africa	35	1998	?	2017, 2020	“shark” not defined	1998 measure called for “full utilization” of sharks – may be gutted and headed. FNA implemented for specific fisheries via permit conditions.
Spain (EU)	2	2003	2003	2003, 2013	Per EU	-
Sri Lanka	24	2001	N	2001, 2015	“sharks” not defined	2015 Regulation extends FB/FNA to High Seas

(continued on next page)

Table 3 (continued)

Fishing Entity	Global Rank	FB	FCR	FNA	Taxonomic Coverage	Comment
Taiwan P. China	7	2012, 2016	RFMO	2012, 2016	Does not define "shark" or "shark fins"	FB, FAA, FNA, FCR for fleets operating under differing conditions, in national (NW) and distant (DW) waters. Implements RFMO CMMS
Tanzania (U.R.)	22	N	N	N	-	-
Thailand	26	N	N	N	-	-
United Kingdom (EU)	30	2003	2003	2003, 2013	Per EU	Following the UK's withdrawal from the European Union in 2020, UK fisheries are now governed by the UK Fisheries Act 2020 and its implementing regulations. These are presumed to incorporate measures to continue application of FB and FNA for UK fishing fleets and fishery waters.
Uruguay	40	RFMO	N	N	RFMO	FCR applies to 1 species exempt from FNA in certain US national waters
USA	5	2000	2011	2011	2016 implementing regulation specifies that the shark finning prohibitions "do not apply to skates and rays"	-
Venezuela	28	2012	N	2012	Defines "shark or sharks" as species of Elasmobranchii, "including rays, stingrays, and chimaeras" and "finning" as the retention of only the fins of a shark and discard of the carcass at sea	This legislation is erroneous in referring to chimaeras as Elasmobranchii. The chimaeras are included in the Subclass Holocephali. FB specifies that all sharks must be transported and landed as complete carcass, with FNA and head and jaw intact for adequate identification but may be gutted.
Viet Nam	Not Ranked	?	?	?	?	-
Yemen	19	?	?	?	?	-

chimaeras. Further, the default definition would cover 99% of the total volume of shark fins identified in the study.

3.4. Public consultations – shark finning requirements

Fifty-two stakeholders across 12 stakeholder groups took part in the MSC's 2021 public consultation (refer to [Supplementary Information](#) for additional information). Overall, stakeholders responded 'strongly disagree' that the proposal to allow alternatives to FNA in any capacity would be 'effective' or 'acceptable' (Fig. 2). NGOs were the most common category to 'strongly disagree', comprising 13 of the 26 respondents for that Likert score. Thematic analysis indicated that the Likert scores for 'strongly disagree' were based on the proposal falling short of the MSC intent that shark finning cannot take place within certified fisheries. Overall, stakeholders felt that FNA should be mandatory for MSC certified fisheries. The key point raised by stakeholders was that allowing alternatives to FNA would create loopholes for finning and ambiguity for associated compliance monitoring and enforcement.

For the 2022 public consultation, which proposed FNA as the sole requirement if sharks were retained, 57 stakeholders across nine stakeholder groups took part. The Likert scores for each of the impact types of 'effective', 'feasible' and 'acceptable', demonstrated that the most common response was 'neither agree nor disagree' (Fig. 3). Compared to the 2021 public consultation, there were a higher number of responses for 'don't know'. Thematic analysis for the responses demonstrated that the 'neither agree nor disagree' and 'don't know' was due to FNA being mandatory for retained sharks being justified, but that the underlying information assessment from the Evidence Requirements required further explanation and should include an assessment of whether FNA is complied with and enforced. Whilst support for FNA being mandatory was widespread, there was a concern raised that FNA could serve as a disincentive to land sharks, resulting in discarding of sharks caught at sea.

3.5. Public consultations – default definition

In the 2021 public consultation, stakeholders were equally divided between 'disagree' or 'agree/strongly agree' that the default definition would be 'effective' (Fig. 4). Most stakeholders responded 'agree/strongly agree' that the default definition was both 'acceptable' and 'feasible' (Fig. 4). Thematic analysis showed the reasons given for those who responded 'disagree' to the default definition being 'effective', related to the default definition needing to include more species, such as all Chondrichthyes. Examples of species groups stakeholders identified that would not be covered by the default definition included skates and mobulid rays. Alternatively, those who responded 'agree/strongly agree' to the proposal being 'effective', did so on the basis that the most relevant species to be assessed for shark finning were included and that it would increase the consistency of MSC assessments.

4. Discussion

Resulting from the global reviews of management measures and public consultations, shark finning in the revised Standard v3.0 [24] is now only assessed at the 'minimum acceptable' level. Fisheries that retain sharks must be governed by a FNA measure that is in place and enforced. A non-retention measure is also permissible at the 'minimum acceptable' level, with the same expectation as for FNA that it is in place and enforced. The default definition of Selachimorpha and Rhinoprismiformes is included such that all species in these taxonomic groups must be assessed in the shark finning requirements. However, if the MSC fishery is managed by an agency that defines the term 'shark' to include additional species (e.g., all Chondrichthyes) their definition shall apply. Overall, the revised requirements have raised the performance 'bar' at the 'minimum acceptable' level for ensuring shark

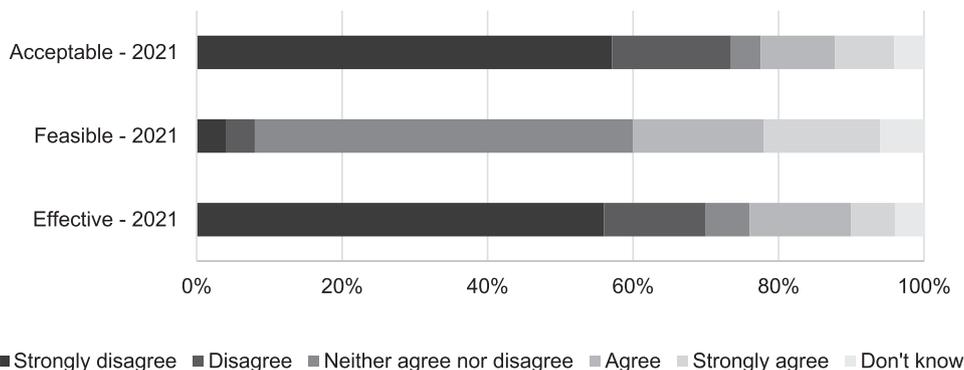


Fig. 2. Likert scores expressed as percentage of responses (n = 52) for the impact types of ‘acceptable’ ‘feasible’ and ‘effective’ from the 2021 public consultation. The proposal during the 2021 public consultation was that alternative measures to FNA were permitted if certain criteria were met for the fishery e.g., the species of shark was managed against specific reference points.

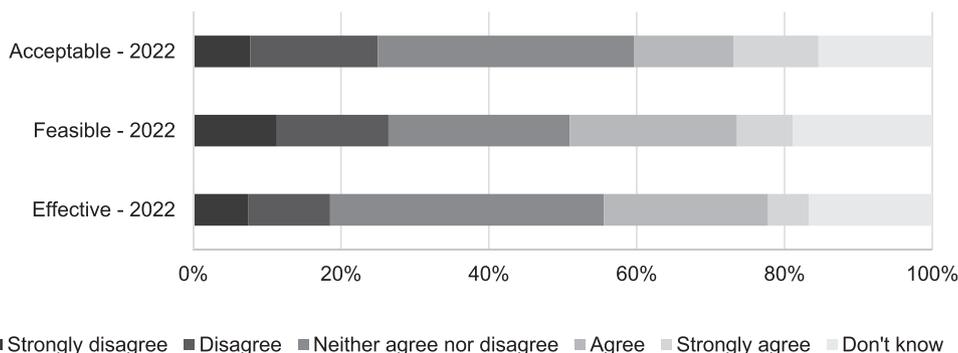


Fig. 3. Likert scores expressed as percentage of responses (n = 57) for the impact types of ‘acceptable’ ‘feasible’ and ‘effective’ from the 2022 public consultation. The proposal during the 2022 public consultation was FNA was mandated for fisheries that retain sharks and underlying information was needed to demonstrate either an FNA or a non-retention measure was in place. The default definition of Selachimorpha and Rhinopristiformes was also included.

finning does not occur in MSC fisheries (refer to [Supplementary Information](#) for the shark finning requirements in the Standard v3.0).

By making these changes, the revised shark finning requirements overcome several issues that were identified throughout the FSR. First, based on the global sample reviewed and from public consultation feedback, the MSC requirements are now more representative of global fisheries management.

Second, as shark finning is now only scored at the ‘minimum acceptable’ performance level, the revised requirements acknowledge that shark finning is a binary issue, as fisheries either meet the requirements or they fail. In turn, this adds an additional benefit that the revised requirements greatly simplify the scoring structure and the assessment process. The shark finning requirements were previously

assessed as an increasing likelihood, across the three performance levels, that shark finning was not occurring. While assessing increasing likelihoods against the three performance levels is valid for many issues (e.g., assessment of stock status against reference points [4]) and is commonplace throughout the Standard, it is not suited to zero tolerance situations. This is because there is an inherent risk that an event is more likely to occur and/or not be detected at lower performance levels.

Third, issues related to fisheries being inadvertently penalised for implementing more rigorous MCS systems will be overcome. The previous requirements in the Standard v2.01 did not adequately account for situations where fisheries that had higher levels of external validation (e.g., observer coverage) were more likely to identify instances of shark finning. Essentially, this created a situation where some fisheries were

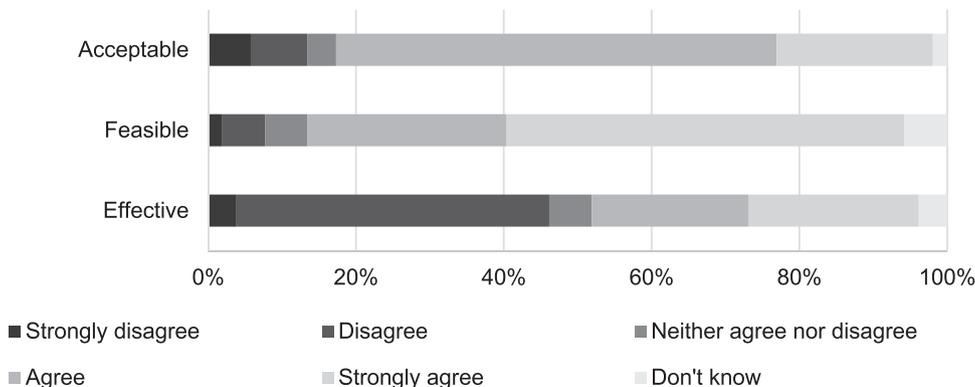


Fig. 4. Likert scores expressed as percentage of responses (n = 52) for the proposal related to the default definition of ‘shark’ from the 2021 public consultation for the impact types of ‘effective’, ‘feasible’ and ‘acceptable’. The default definition was proposed as Selachimorpha and Rhinopristiformes.

'hoisted by their own petard' for implementing more rigorous MCS systems. Although there was an allowance for fisheries to demonstrate that rare and isolated events were not systematic, this ran counter to the MSC policy that shark finning cannot occur in certified fisheries. That allowance has been removed from the Standard v3.0, with the result that all fisheries will now need to demonstrate they have an FNA or non-retention measure in place and enforced. Thus, the application of the revised shark finning requirements will not penalise fisheries that have rigorous MCS systems and will lift the performance of those that may have been able to circumvent aspects of the previous requirements.

To establish appropriate performance levels for how shark finning measures should be scored within the Standard, it was necessary to examine how management agencies have adopted relevant compliance measures associated with a finning ban. The assessment of shark finning in the Standard was established to ensure shark finning was not occurring in certified fisheries, akin to a shark finning ban. Of the 43 fishing entities reviewed, 20 were confirmed to have banned shark finning beyond their RFMO obligations, with 18 of these 20 (90%) having implemented FNA for at least a portion of their fishing fleet. Against the MSC scoring criteria of 'minimum acceptable', 'best practice' or 'state of the art', such broadscale adoption indicated FNA was suitable for the 'minimum acceptable' performance level. This was further supported by the results of the public consultations. Based on these results and considering the MSC intent, it became obvious that an FNA measure should be mandatory for MSC certified fisheries that retain sharks. Further, allowing a non-retention measure at the 'minimum acceptable' performance level was also justified in cases where the fishery might encounter, but be prohibited from retaining sharks onboard.

Determining the performance level with respect to a default definition of 'shark' was less clear, as no obvious patterns were identified. This was primarily due to variability and inconsistencies with respect to management agencies' definition of the term. Additionally, public consultation feedback was more divided on this issue than for the proposed FNA requirement, particularly for the 'effective' impact category. Numerous public consultation responses outlined that both the International Union for the Conservation of Nature (IUCN) and the FAO IPOA-Sharks define sharks as any species of chondrichthyan [12,30]. However, neither is a management instrument and these definitions are not codified in law. As such, their relevance to determining a performance level within the Standard is lower than that of explicit fisheries management measures. For national entities, only Australia applied the definition of the IUCN and IPOA-Sharks, i.e., all chondrichthyans, without exemptions.

The proposed default definition that went to public consultation was to include all Selachimorpha (true sharks) and Rhinopristiformes. Rhinopristiformes were included as they represent some of the most valued fins in the shark fin trade, while being one of the most threatened groups of marine fishes [16,31]. As there was no clear trend in terms of management agencies adopting a definition, nor the results of the public consultation for whether the proposed default definition would be 'effective', the focus became how the proposed default definition would apply to the species that are present within the shark fin trade. When applied to the results by Fields et al., 2017 [29], the default definition would cover 95% of species and 99% of the volume of species. These results therefore indicated that the default definition of Selachimorpha and Rhinopristiformes was appropriate. Applying this default definition will have several benefits. First, it covers the most prevalent and threatened species in the shark fin trade. Second, it simplifies the previous requirements and will lead to more consistent outcomes for MSC certifications. If the same species are consistently assessed, irrespective of the fishery, gear type or area, it is posited that the revised requirements will increase the impact that MSC certification can have to reduce the threats and issues associated with shark finning. Third, in some cases it will also increase the number of species that need to be considered. For example, the US excludes "skates and rays" from their definition of shark, possibly creating a legal loophole for finning of

guitarfishes and other Rhinopristiformes. However, if any fleet managed by the US sought MSC certification, the MSC assessment would need to consider a broader range of species than the US mandates, given the MSC default definition includes Rhinopristiformes.

As noted in some public consultation responses, the default definition would not cover skates or mobulid rays. These species, however, were absent from the Hong Kong study (which focused on shark fins) and likely feature in separate trades, such as skates for skate wings and, in Korea, for a traditional delicacy, fermented skate [32], and mobulid rays for their gill plates [33]. Further, the revised requirements are not restrictive in terms of only assessing Selachimorpha and Rhinopristiformes. Due to the lack of a clear global trend across the reviewed management agencies, the revised requirements necessitate that if the fishery seeking MSC certification is managed by an agency that defines the term 'shark' to include additional species (e.g., all chondrichthyans or elasmobranchs), these additional species will also need to be assessed with respect to shark finning. This level of flexibility will therefore allow species identified by stakeholders, e.g., skates or mobulid rays, to be considered should global trends shift to include these species within shark finning measures, more broadly.

The adoption of measures related to shark finning has progressed in recent years. This is particularly true for the RFMOs, as FNA was first introduced in 2015 and is now in place for five RFMOs, including two of the four tropical tuna RFMOs. Of the four tropical tuna RFMOs, both WCPFC and Indian Ocean Tuna Commission (IOTC) allow exemptions to FNA, namely having fins artificially attached using ropes or wire (WCPFC) or permitting FCR for frozen sharks (IOTC). The expansion of FNA rules among these RFMOs should assist in reducing shark finning in the fisheries under their jurisdiction, providing there is an adequate level of compliance monitoring and enforcement. The adoption of national FNA measures generally occurred earlier than for the RFMOs, as 13 of the 18 fishing entities did this prior to 2013. This demonstrates that most national jurisdictions had adopted FNA prior to the date that the shark finning requirements were first released. However, given that no RFMOs had adopted FNA, the landscape at the time indicated that FNA was best suited to the 'best practice' level within the requirements. This was the case, with alternative measures such as FCR also permitted at the 'best practice' level, where external validation levels, through observer coverage, were adequate.

Particularly noteworthy is the number of RFMOs and fishing entities that have not – or, based on the research conducted, appear to have not – adopted a shark finning ban, including beyond their RFMO obligations. More than half of the national 43 fishing entities and six of the 15 RFMOs reviewed have yet to prohibit shark finning. Among these are countries responsible for some of the world's largest shark catches. Although issues have been identified with respect to implementing shark finning bans [34], finning bans represent a clear intent to reduce an inhumane, unsustainable and wasteful fishing practice. Further, finning bans create a foundation onto which additional shark fisheries management policies, measures and MCS can be established [14].

In relation to conservation objectives related to reducing fishing mortality, shark finning bans and non-retention measures have been identified as being potentially ineffective on their own. This is primarily due to these measures not requiring accurate catch data, not including catch limits and not assessing if current catch levels are sustainable [34, 35]. When applied in totality, the Standard v3.0 requires that such issues are potentially overcome. If an MSC certified fishery interacts with a species of shark, the status of that species needs to be known and assessed against specified thresholds. For example, if a species of shark is classified as Endangered, Threatened and Protected/Out of Scope (ETP/OOS), the MSC assessment must determine the likelihood the MSC fishery is not hindering the recovery to favourable conservation status, being at least 50% of the carrying capacity for that population [24]. The underlying information to inform that determination is also required, with the Standard v3.0 requiring an appraisal of the underlying information used to assess a fishery. This includes the Evidence Requirements

Framework requiring a 30% level of independent observation (i.e., observer coverage) for fisheries that are managed by an RFMO, operate in the high seas and interact with ETP/OOS [36]. As species such as silky sharks (*Carcharhinus falciformis*) and oceanic whitetip sharks (*C. longimanus*) are caught in RFMO managed fleets that operate in the high seas and are often determined as ETP/OOS in MSC assessments, the revised requirements provide a strong mechanism to address the identified shortcomings of finning bans or non-retention measures on their own.

5. Conclusions

Shark conservation has become an emotive topic, with issues such as shark finning gaining worldwide attention [37,38]. Throughout the FSR, the MSC received 11 letters from stakeholders outside of public consultation responses, primarily from NGOs advocating for specific positions. Against this backdrop, approaching the topic of shark finning in a dispassionate manner was a key objective. By undertaking a data-driven approach, it was possible to develop justifiable requirements at the most appropriate performance level that reflect the current global management landscape with respect to shark finning. This included a default definition with relation to the species assessed against the shark finning requirements and determining that FNA is now a 'minimum acceptable' measure when it comes to addressing shark finning.

The revised requirements in the Standard v3.0 now ensure MSC fisheries that capture a shark, whether it is retained or released, will need to 1) undertake an assessment of its population status, 2) determine whether a FNA or non-retention measure is in place and enforced, including for ETP/OOS species, and 3) specific to the shark finning requirements, provide consistent assessments of species across all certified fisheries. There could never be a means to fully guarantee that a single shark finning event did not occur. However, the revised requirements represent a significant step forward to ensure that shark finning does not occur within MSC certified fisheries and that the appropriate species are assessed.

Funding

This work was funded through the Fisheries Standard Review process and the Walton Foundation through the Marine Stewardship Council Grant 2019-377.

CRediT authorship contribution statement

Adrian N. Gutteridge: Conceptualisation, Investigation, Methodology, Research, Writing – original draft, Writing – review & editing; Visualisation; project administration. **Amie Bräutigam:** Investigation, Methodology, Research, Writing – original draft preparation. Writing – review & editing. **Kate Dewar:** Conceptualisation, Investigation, Methodology, Research, Writing – original draft preparation, Writing – review & editing; Visualisation; project administration. **Rohan J. C. Currey:** Conceptualisation, Writing – original draft preparation, Writing – review & editing, Supervision.

Declaration of Competing Interest

Adrian Gutteridge, Kate Dewar, and Rohan Currey
o Employees of the MSC.

Amie Bräutigam

o Consultant engaged by the MSC during the Fisheries Standard Review (FSR) to produce a report that outlined the global management measures associated with shark finning.

- As outlined in the manuscript, the results of the report that A. Bräutigam produced informed the project in the FSR and form the basis for some of the information

presented in this report. Her report, along with the results of the public consultations, were published online during the FSR on the MSC website. Her report as well as the results of the public consultations related to shark finning have not been produced in any primary literature or scientific journal.

Data availability

The authors do not have permission to share data.

Acknowledgements

The authors would like to thank all the participants in the MSC public consultations during the FSR. Victor Restrepo, as the MSC Technical Advisory Board (TAB) project sponsor, the MSC TAB and Stakeholder Advisory Council (STAC) all provided valuable input to help frame the project throughout the FSR. Mike Melnychuk provided valuable feedback on an earlier version of the manuscript. Ernesto Jardim, Emily McGregor and Polly Burns all contributed massively to help the project stay on task and meet the many milestones and deadlines throughout the years it took to complete this work. Miki Takada was invaluable in helping to track down references used in the manuscript. We also thank the editor and two anonymous reviewers whose feedback improved the manuscript.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.marpol.2024.106119](https://doi.org/10.1016/j.marpol.2024.106119).

References

- [1] Y. Stratoudakis, P. McConney, J. Duncan, A. Ghofar, N. Gitonga, K.S. Mohamed, M. Samoilys, K. Symington, L. Bourillon, Fisheries certification in the developing world: locks and keys or square pegs in round holes? *Fish. Res.* 182 (2016) 39–49, <https://doi.org/10.1016/j.fishres.2015.08.021>.
- [2] A. Pierucci, S. Columbu, L.T. Kell, A global review of MSC certification: Why fisheries withdraw? *Mar. Policy* 143 (2022) <https://doi.org/10.1016/j.marpol.2022.105124>.
- [3] D.J. Agnew, Who determines sustainability? *J. Fish. Biol.* 94 (2019) 952–957, <https://doi.org/10.1111/JFB.13928>.
- [4] M.C. Melnychuk, A. Veneziano, S. Lees, J. Rasal, L.M. Koerner, P. Hair, D. Costalago, D. Hively, E. Jardim, C. Longo, Wild-caught fish populations targeted by MSC-certified fisheries have higher relative abundance than non-MSC populations, *Front. Mar. Sci.* 9 (2022) 1–21, <https://doi.org/10.3389/fmars.2022.818772>.
- [5] L.M. Bellchambers, E.A. Fisher, A.V. Harry, K.L. Travaile, Identifying and mitigating potential risks for Marine Stewardship Council assessment and certification, *Fish. Res.* 182 (2016) 7–17.
- [6] S.R. Bush, H. Toonen, P. Oosterveer, A.P.J. Mol, The 'devils triangle' of MSC certification: Balancing credibility, accessibility and continuous improvement, *Mar. Policy* 37 (2012) 288–293, <https://doi.org/10.1016/j.marpol.2012.05.011>.
- [7] R. Blasiak, A. Dauriach, J.B. Jouffray, C. Folke, H. Österblom, J. Bebbington, F. Bengtsson, A. Causevic, B. Geerts, W. Grønbrekk, P.J.G. Henriksson, S. Käll, D. Leadbitter, D. McBain, G.O. Crespo, H. Packer, I. Sakaguchi, L. Schultz, E. R. Selig, M. Troell, J. Villalón, C.C.C. Wabnitz, E. Wassénius, R.A. Watson, N. Yagi, B. Crona, Evolving perspectives of stewardship in the seafood industry, *Front Mar. Sci.* 8 (2021), <https://doi.org/10.3389/fmars.2021.671837>.
- [8] L.M. Robinson, I. van Putten, B.S. Cavve, C. Longo, M. Watson, L. Bellchambers, E. Fisher, F. Boschetti, Understanding societal approval of the fishing industry and the influence of third-party sustainability certification, *Fish. Res.* 22 (2021) 1213–1226, <https://doi.org/10.1111/faf.12583>.
- [9] D.J. Agnew, N.L. Gutiérrez, A. Stern-Pirlot, D.D. Hoggarth, The MSC experience: developing an operational certification standard and a market incentive to improve fishery sustainability, *ICES J. Mar. Sci.* 71 (2014) 216–225, <https://doi.org/10.1093/icesjms/fst091>.
- [10] MSC, MSC Fisheries Standard v2.01, London, 2018. (https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/fisheries-program-documents/msc-fisheries-standard-v2-01.pdf?sfvrsn=8ecb3272_19#page=182&zoom=100,92,674).
- [11] N.K. Dulvy, S.L. Fowler, J.A. Musick, R.D. Cavanagh, P.M. Kyne, L.R. Harrison, J. K. Carlson, L.N. Davidson, S.V. Fordham, M.P. Francis, C.M. Pollock, C. A. Simpfendorfer, G.H. Burgess, K.E. Carpenter, L.J. Compagno, D.A. Ebert, C. Gibson, M.R. Heupel, S.R. Livingstone, J.C. Sanciangco, J.D. Stevens, S. Valenti,

- W.T. White, Extinction risk and conservation of the world's sharks and rays, *Elife* 3 (2014), <https://doi.org/10.7554/elife.00590>.
- [12] FAO, International plan of action for the conservation and management of sharks, Food and Agriculture Organization of the United Nations, Rome, 1999.
- [13] L. Biery, D. Pauly, A global review of species-specific shark-fin-to-body-mass ratios and relevant legislation, *J. Fish. Biol.* 80 (2012) 1643–1677, <https://doi.org/10.1111/j.1095-8649.2011.03215.x>.
- [14] S. Fowler, B. Séret, Shark fins in Europe: Implications for reforming the EU finning ban, 2010.
- [15] F. Dent, S. Clarke, State of the global market for shark products: FAO Fisheries and Aquaculture Series Technical Paper No. 590., Rome, 2015. (<https://www.researchgate.net/publication/303265323>).
- [16] N.K. Dulvy, N. Pacoureau, C.L. Rigby, R.A. Pollom, R.W. Jabado, D.A. Ebert, B. Finucci, C.M. Pollock, J. Cheok, D.H. Derrick, K.B. Herman, C.S. Sherman, W. J. VanderWright, J.M. Lawson, R.H.L. Walls, J.K. Carlson, P. Charvet, K.K. Bineesh, D. Fernando, G.M. Ralph, J.H. Matsushiba, C. Hilton-Taylor, S.V. Fordham, C. A. Simpfendorfer, Overfishing drives over one-third of all sharks and rays toward a global extinction crisis, *Curr. Biol.* 31 (2021) 4773–4787.e8, <https://doi.org/10.1016/j.cub.2021.08.062>.
- [17] D.S. Shiffman, R.E. Hueter, A United States shark fin ban would undermine sustainable shark fisheries, *Mar. Policy* 85 (2017) 138–140, <https://doi.org/10.1016/j.marpol.2017.08.026>.
- [18] J. Santana-Garçon, S. Fordham, S. Fowler, Blue shark *Prionace glauca* fin-to-carcass-mass ratios in Spain and implications for finning ban enforcement, *J. Fish. Biol.* 80 (2012) 1895–1903, <https://doi.org/10.1111/j.1095-8649.2012.03233.x>.
- [19] S.J.B. Gulak, H.E. Moncrief-Cox, T.J. Morrell, A.N. Mathers, J.K. Carlson, A guide to landing shark species with fins naturally attached: NOAA Technical Memorandum NMFS-SEFSC-712, 2017. (<https://doi.org/10.7289/V5/TM-SE-FSC-712>).
- [20] L.J. Marshall, The Fin Blue Line: Quantifying fishing mortality using shark fin morphology, University of Tasmania, 2011.
- [21] MSC, Marine Stewardship Council Certification Requirements Version 1.3, 2013. (https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/fisheries-program-documents/msc-certification-requirements_v1_3.pdf?sfvrsn=44528820_20).
- [22] MSC, MSC Fisheries Certification Process v2.2, MSC, 2020. (<https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/fisheries-program-documents/msc-fisheries-certification-process-v2-2.pdf>) (accessed January 23, 2023).
- [23] S. Fowler, A. Bräutigam, N. Okes, G. Sant, Conservation, Fisheries, Trade and Management Status of CITES-Listed Sharks BFN-Skripten 607, Bonn, 2021. (<http://doi.org/10.19217/skr607>).
- [24] MSC, MSC Fisheries Standard v3.0, 2022. (<https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/fisheries-program-documents/msc-fisheries-standard-v3-0.pdf>) (accessed January 20, 2023).
- [25] A. Bräutigam, Best practice in the prevention of shark finning - consultancy report to the Marine Stewardship Council, 2020. (<https://www.msc.org/docs/default-source/default-document-library/stakeholders/fsr-consultant-reports/best-practice-in-the-prevention-of-shark-finning-report.pdf>) (accessed January 23, 2023).
- [26] J. Fischer, K. Erikstein, B. D'Offay, S. Guggisberg, M. Barone, Review of the implementation of the International Plan of Action for the conservation and management of sharks: FAO Fisheries and Aquaculture Circular No. 1076, Rome, 2012. (www.fao.org/icalog/inter-e.htm).
- [27] D.A. Ebert, M. Dando, S. Fowler, *Sharks of the world: A complete guide*, Princeton University Press, Princeton, 2021.
- [28] P.R. Last, W.T. White, M.R. de Carvalho, B. Seret, F.W. Stehmann, G.J.P. Naylor, *Rays of the world*, CSIRO Publishing, Clayton South, 2016.
- [29] A.T. Fields, G.A. Fischer, S.K.H. Shea, H. Zhang, D.L. Abercrombie, K.A. Feldheim, E.A. Babcock, D.D. Chapman, Species composition of the international shark fin trade assessed through a retail-market survey in Hong Kong, *Conserv. Biol.* 32 (2017) 376–389, <https://doi.org/10.1111/cobi.13043>.
- [30] IUCN, IUCN Shark Specialist Group: Frequently Asked Questions: Sharks, Rays, and chimaeras, (2022). (<https://www.iucnssg.org/Faqs.Html>) (accessed November 3, 2023).
- [31] A.B.M. Moore, Are guitarfishes the next sawfishes? Extinction risk and an urgent call for conservation action, *Endanger. Species Res* 24 (2017) 75–88, <https://doi.org/10.3354/esr00830>.
- [32] C.-C. Zhao, J.-B. Eun, Shotgun metagenomics approach reveals the bacterial community and metabolic pathways in commercial hongeo product, a traditional Korean fermented skate product, *Food Res. Int.* 131 (2020) 109030, <https://doi.org/10.1016/j.foodres.2020.109030>.
- [33] A. Marshall, R. Barreto, J. Carlson, D. Fernando, S. Fordham, M.P. Francis, K. Herman, R.W. Jabado, K.M. Liu, N. Pacoureau, *Mobula alfredi* (amended version of 2019 assessment). The IUCN Red List of Threatened Species, 2022. (<https://doi.org/10.2305/IUCN.UK.2022-1.RLTS.T195459A214395983.en>).
- [34] S.C. Clarke, S.J. Harley, S.D. Hoyle, J.S. Rice, Population trends in Pacific oceanic sharks and the utility of regulations on shark finning, *Conserv. Biol.* 27 (2013) 197–209, <https://doi.org/10.1111/j.1523-1739.2012.01943.x>.
- [35] N.K. Dulvy, J.K. Baum, S. Clarke, L.J.V. Compagno, E. Cortés, A. Domingo, S. Fordham, S. Fowler, M.P. Francis, C. Gibson, J. Martínez, J.A. Musick, A. Soldo, J.D. Stevens, S. Valenti, You can swim but you can't hide: the global status and conservation of oceanic pelagic sharks and rays, *Aquat. Conserv* 18 (2008) 459–482, <https://doi.org/10.1002/aqc.975>.
- [36] MSC, MSC Fisheries Standard Toolbox v1.1, 2022. (<https://www.msc.org/docs/default-source/default-document-library/for-business/program-documents/fisheries-program-documents/msc-fisheries-standard-toolbox.pdf>) (accessed January 20, 2023).
- [37] A. Dell'Apa, M.C. Smith, M.Y. Kaneshiro-Pineiro, The influence of culture on the international management of shark finning, *Environ. Manag.* 54 (2014) 174210, <https://doi.org/10.1007/s00267-014-0291-1>.
- [38] E. Jeffreys, Translocal celebrity activism: shark-protection campaigns in mainland China, *Environ. Commun.* 10 (2016), <https://doi.org/10.1080/17524032.2016.1198822>.

Glossary of terms

- Best practice:** Global best practice performance level within the MSC Fisheries Standard. It is scored at scoring guidepost (SG) 80, with conditions set during certification needing to achieve this performance level.
- ETP/OOS:** Endangered, threatened, or protected (ETP) species and species out of scope (OOS) of the MSC program (birds, mammals, amphibians, and reptiles).
- Fins naturally attached (FNA):** Requires all retained sharks to be landed with their fins still attached to the carcass by prohibiting the removal of shark fins on board vessels as well as the prohibition of retaining onboard, transshipping or landing removed shark fins. This definition applies to the MSC Fisheries Standard v3.0.
- Fins-to-carcass ratio (FCR):** Allows the fins of a shark to be removed at sea but subject to a ratio of trunks to fins
- FSR:** Fisheries Standard Review. The FSR is a review of the MSC Fisheries Standard that occurs every 5 years to address issues raised, best practice guidance and new scientific knowledge. The FSR referred to in this paper culminated in the release of the MSC Fisheries Standard v3.0 in 2022.
- IUU:** Illegal, Unsustainable and Unregulated fishing
- In-scope species:** Species within scope of the MSC program (fish and invertebrates) that are not covered under Principle 1 and are not ETP/OOS species.
- Likert score:** A scale response or answer commonly involved in research that employs questionnaires. For the FSR, participants in the public consultations were asked to rate their responses to questions from 1 to 5, with 1 being strongly disagree and 5 being strongly agree.
- Minimum acceptable:** The minimum acceptable performance level in the MSC Fisheries Standard. This performance level is scored at the scoring guidepost 60 level. If fisheries are scored at this performance level, they are assigned a condition to improve to the 'best practice level' at SG80 during their certification
- MCS:** Monitoring, control and surveillance
- Performance Indicator:** The lowest level of sub-criterion of an MSC Criterion in the decision tree; the level at which the performance of the fishery is scored by the team.
- Principle 1:** Principle 1 of the MSC Fisheries Standard. Species assessed in Principle 1 are the target species of the Unit of Assessment (UoA) and are eligible to carry the eco-label if certification is achieved
- Principle 2:** Principle 2 of the MSC Fisheries Standard. Species assessed in Principle 2 are those not covered under Principle 1 and include ETP species
- RFMO:** Regional Fisheries Management Organisation
- Scoring Guidepost:** The benchmark level of performance established by the team in respect of each numeric score or rating for each indicator sub-criterion.
- State-of-the-art:** The highest possible performance level within the MSC Fisheries Standard. It is scored at scoring guidepost (SG) 100.
- SG100:** Refer to 'state-of-the-art'
- SG60:** Refer to 'minimum acceptable'
- SG80:** Refer to 'best practice'