Maldives Sea Cucumber Fishery Management Plan

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Contributing Authors:
Munshidha Ibrahim, Maleeha Haleem, Hawwa Raufath Nizar, Aminath Lubna

Other contributors:
Mohamed Ahusan, Hussain Sinan, Aishath Sarah Hashim, Ahmed Shifaz, Adam Ziyad, Hussein Zameel, Adam Manik

Reviewed by:
Dr Charles Anderson and Environmental Markets Solution Lab (emLab), UCSB

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Ministry of Fisheries, Marine Resources and Agriculture
7th Floor, Velaanaage
Ameer Ahmed Magu
Malé, 20096
Republic of Maldives,

www.fishagri.gov.mv

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Foreword

Praise be to Allah, the Creator of the oceans, marine life and other blessings upon the earth. Prayers and peace be upon our Prophet, Muhammad, who taught us the righteous way to make use of these blessings.

The oceans, lagoons and reefs are national heritages that are inextricably linked to our culture, tradition, and the Maldivian identity. The Maldives fisheries are heavily dependent on this heritage. Hence it is our utmost responsibility to ensure that they are faithfully passed down to our future generations. The Ministry is committed to working towards achieving this goal, and to implement the government's policies on the expansion of the blue economy agenda. To this end, we have compiled this plan to steer our efforts towards maximising long-term benefits of marine resources to Maldivians.

Since the time of our forefathers, the fishery sector has been a major pillar of our economy, upon which our incomes, our livelihoods and our sustenance are dependent. Therefore, the measures included in these fisheries management plans are geared towards the sustainable development and management of these fisheries resources. These legally recognised fisheries management plans mark a watershed moment in the history of marine resource management in the Maldives.

Fisheries resources are common goods, of which all Maldivians hold a share. These plans have been developed based on principles of the Precautionary Approach, Ecosystem-Based Management, Sustainable Development and Equity, with due regard to the various and variety of interactions within an ecosystem and to ensuring timely and cost-effective measures are taken to safeguard ecosystems and prevent irreparable damage to them. This process has been informed by meaningful suggestions and constructive feedback from various stakeholders including fishers, others engaged directly and indirectly within the fisheries sector as well as civil society organisations working towards natural resource management, conservation, and protection.

The fisheries management plans will be the primary basis for guiding the authorities as well as stakeholders in the sustainable management of the fisheries sector in the Maldives. These plans comprise of developmental goals and objectives for each fishery, measures and actions to achieve them, the roles and responsibilities of stakeholder agencies in the implementation of these measures and an implementation timeline for the measures. It is my sincere hope that these plans contribute towards realising the vision set forth by the Fisheries Act of the Maldives.

—

Zaha Waheed

Minister of Fisheries, Marine Resources
and Agriculture

Abbreviations

FIS	Fisheries Information System
IGO	Intergovernmental Organisation
LGA	Local Government Authority
MCS	Monitoring,Control and Surveillance
MCS*	Maldives Customs Service
ME	Ministry of Environment
MFDA	Maldives Food and Drug Authority
MIRA	Maldives Inland Revenue Authority
MMRI	Maldives Marine Research Institute
MNDF - CG	Maldives National Defence Force – Coast Guard
MoE	Ministry of Education
MoED	Ministry of Economic Development
MoFMRA	Ministry of Fisheries,Marine Resources and Agriculture
MPS	Maldives Police Services
NBS	National Bureau of Statistics
RFB	Regional Fisheries Body
SDFC	SME Development Finance Corporation
SWIOFC	Southwest Indian Ocean Fisheries Commission
UCSB	University of California,Santa Barbara

Chapter 1

Preamble

1.1 Introduction and Title

This Plan is made pursuant to Article 18 of the Act No. 2019/14 (Fisheries Act of the Maldives) and provides for the management of the fishery stated in Section 17 (a) (12) of the Act. The plan will be the primary basis for guiding the authorities as well as stakeholders in the sustainable development of the sea cucumber fishery and trade in the Maldives. This Management Plan shall be cited as "Maldives Sea Cucumber Fishery Management Plan".

1.2 Overall purpose

The overall purpose of the management plan is to:

(a) Ensure long-term benefits to the people of Maldives through the responsible management of the sea cucumber fishery; and

(b) Guide the authorities and stakeholders in the sustainable development of the sea cucumber fishery and trade in the Maldives.

1.3 Scope and Application

This Plan applies to all species belonging to the Class Holothuroidea, commonly known as sea cucumbers. This Plan applies to all activities carried out in the Maldives that may impact sea cucumber resources, including but not limited to collecting, aquaculture, processing, storage, trading, and exporting of sea cucumber and sea cucumber products from the Maldives. The Plan also applies to all parties, vessels, aquaculture facilities, processing and export facilities or places engaged in or otherwise connected with any activity within the scope of this Plan.

1.4 Guiding Principles

1.1.1 Precautionary Approach: Timely and cost-effective measures shall be taken to safeguard ecosystems and prevent irreparable damage to them despite the lack of full scientific certainty.

1.1.2 Ecosystem-based management: The various and variety of interactions within an ecosystem, including anthropogenic elements, shall be recognised as opposed to accounting for matters, species, or ecosystem services in isolation.

1.1.3 Universal Responsibility: Local policies governing marine resource management shall be in harmony with global efforts to protect, conserve and manage biodiversity.

1.1.4 Sustainable Development: In developing the fishery, the needs of the present shall be met without compromising the ability of the future generations to benefit from the resource.

1.1.5 Equity: Resources shall be acknowledged as a shared common good, and benefits obtained from the utilisation of resources shall be shared in a fair and just manner among all through the application of transparency, legitimacy, accountability and decentralisation.

1.1.6 Participatory Approach: All stakeholders, particularly those who are directly affected by a policy or a measure, shall be engaged in the decision-making process to ensure inclusivity and consensus-oriented outcomes.

1.5 Interpretation

Unless stated otherwise, words or expressions used in this Plan have been given the meanings specified in Annex 1: Glossary.

1.6 Entry into Force

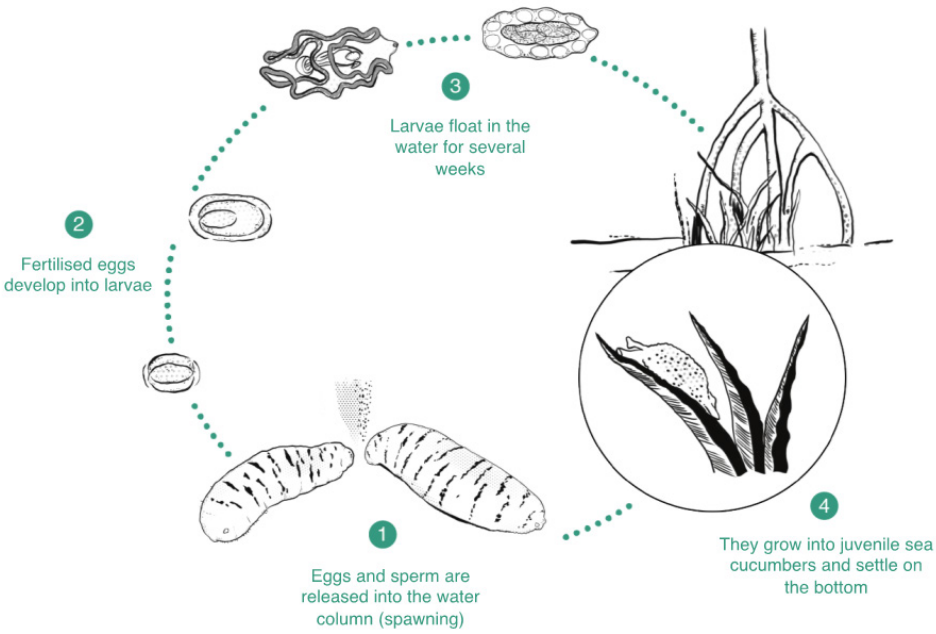
This Plan shall come into force upon its publication on the Government Gazette.

Chapter 2

Biology, Habitat and Behaviour

2.1 Biology

Sea cucumbers are "elongated tubular or flattened soft-bodied marine benthic invertebrates" (Anderson et al. 2011) belonging to the class Holothuroidea. There are around 1400 known species of sea cucumbers distributed around the world (Pawson 2007). Life-history information for most sea cucumber species is unknown (Lovatelli et al. 2004) with limited existing studies finding a high degree of variability amongst individual traits. Some grow and reach reproductive maturity within one or two years, while others have been found to take up to 6 years (Sloan 1984). Known lifespans range from 15 - 5 years (Purcell 2010). Most sea cucumbers are gonochoric and breed sexually via broadcast spawning, although some undergo asexual reproduction. During spawning, motile sperm and oocytes (unfertilized eggs) are released directly into the water column, with fertilisation occurring in mid-water (Purcell 2010). Reproductive success is density-dependent and requires sea cucumbers to be in close proximity to each other to avoid asynchronous spawning (Mercier and Hamel 2009). A typical life cycle of a sea cucumber is shown in Figure 1.



- **Figure 1:** Life cycle of a sea cucumber

2.2 Habitat and Behavioural Traits

Sea cucumbers are found in nearly all benthic marine habitats, ranging from the deep sea to intertidal mud flats (including shallow coral reefs, tropical lagoons and inshore seagrass beds) and from polar waters to the tropics (Purcell et al. 2016). The habitat requirements, movement patterns, population densities and broad spatial distribution of sea cucumbers are functions of various factors such as depth (Mercier et al. 2000), food availability (Navarro et al. 2014 ,2013), temperature fluctuations, pH conditions as well as presence of predators (Birkeland 1989). The majority of sea cucumbers feed either by taking particulate material from the sea floor or by swallowing large amounts of the nutrient loaded substratum through which they burrow. However, several species of sea cucumbers have been found to feed upon particles in suspension as well (Fankboner 1978). Although sea cucumbers are known to be often sedentary, they have been found to move in direct response to different environmental conditions (Young and Chia 1982). For example, the distribution of suspension-feeding sea cucumbers has been linked to water motion and its likelihood of bringing food particles within reach of their tentacles (Fankboner 1978), and deposit-feeding species have been found to congregate in areas rich in organic food sources (Navarro et al. 2013).

The influence of light intensity and temperature fluctuations on the daily activities of some species has also been observed, whereby smaller juveniles were found to be buried around sunrise and emerged close to sunset, while larger juveniles buried when temperatures fell and emerged during mid-day (Mercier et al. 1999).

2.3 Ecological Significance

Sea cucumbers play fundamental roles in the ecosystem, contribute greatly to faunal community biomass, and play an important role in regulating physico-chemical processes of soft-bottom and reef ecosystems (Birkeland, 1989; Purcell et al. 2016). Deposit-feeding sea cucumbers feed on organic detritus mixed with sand and silt in the upper few millimetres of sediments and influence the stratification and stability of the sediment via ingestion and bioturbation (reworking, stirring or mixing of sediment layers), and suspension-feeding sea cucumbers modify water quality by altering its carbonate content and pH (Purcellet al. 2016). Sea cucumbers re-mineralise large quantities of organic nutrients as they digest bacteria, diatoms and detritus, and play a crucial role in nutrient cycling, which increases benthic productivity of coral reefs (Uthicke et al. 2004). They are also known to host many ectocommensal species such as copepods, crabs, and shrimps as well as endocommensals like Protozoa (gregarines, coccidias); Platyhelminthes (Acoela, numerous Turbellaria, Rhabdocoela, and Trematoda); and various species of fishes (Purcell et al. 2016). Sea cucumbers also add value to food chains by transferring energy from microalgae and organic detritus to higher trophic consumers including several species of seastar, crustaceans, gastropods, and fishes (Purcell et al. 2016; Francour, 1997). The removal of sea cucumbers from the environment with no management considerations can have ecological consequences such as the disruption of overall productivity of coral reef ecosystems.

Chapter 3

Overview of the Sea Cucumber Fishery

3.1 Recorded species

Approximately 27 species of sea cucumbers have been recorded in the Maldives (Joseph 1992; Bers 2005; Muthiga 2008; Purcell et al. 2012; Ducarme 2016 ,2015), around 15 of which are mostly targeted by fishers (Annex 2).

Table 1 List of Sea Cucumber Species Recorded in the Maldives.

Scientific Name	Common Name	Local Name	Reference
Actinopyga caerulea	Blue Sea Cucumber	-	Ducarme (2015)
Actinopyga echinites	Brownfish	-	Joseph (1992)
Actinopyga lecanora	Stonefish	Fili mushi / Buffulhi	Ducarme (2015)
Actinopyga mauritiana	Surf Redfish	Raiy Mushi	Joseph (1992)
Actinopyga miliaris	Blackfish	Kalhu Mushi	Joseph (1992)
Bohadschia argus	Leopardfish	Summit Kiru / Lahjehi Kiru	Andréfouët (2012)
Bohadschia atra	Tigerfish	-	Ducarme (2016)
Bohadschia marmorata	Chalkfish	Hudhu kiru	Purcell et al. (2012)
Bohadschia vitiensis	Brown Sandfish	Gaabulhaa	(Ducarme 2016)
Holothuria atra	Lollyfish	Holhi	Purcell et al. (2012)

Holothuria cinerascens	Ashy Sea Cucumber	-	Purcell et al. (2012)
Holothuria edulis	Pinkfish	-	(Ducarme 2016)
Holothuria fuscogilva	White Teatfish	Kan'du batu	Joseph (1992)
Holothuria fuscopunctata	Elephant Trunkfish	Elephant / Van'dhukeyo	Joseph (1992)
Holothuria hilla	Tiger-Tail Sea Cucumber	-	Muthiga (2008)
Holothuria leucospilota	White Thread Fish	-	Muthiga (2008)
Holothuria nobilis	Black Teatfish	Falhu batu	Joseph (1992)
Holothuria sp. (type 'Pentard')	Flower Teatfish	-	Purcell et al. (2012)
Pearsonothuria graeffei	Flowerfish	-	Purcell et al. (2012)
Stichopus chloronotus	Greenfish	Kashi / Feeru	Purcell et al. (2012)
Stichopus herrmanni	Curryfish	Curry	Purcell et al. (2012)
Stichopus horrens	Selenka's Sea Cucumber	-	Purcell et al. (2012)
Synapta maculate	Spotted Worm Sea Cucumber	-	Joseph (1992)
Synaptula sp.	-	-	Andréfouët (2012)
Thelenota ananas	Prickly Redfish	Alanaasi	Purcell et al. (2012)
Thelenota anax	Amberfish	Kahchala	Joseph (1992)
	Black tiger	Kalhu kiru	Anecdotal, not recorded in literature

3.2 Fishery

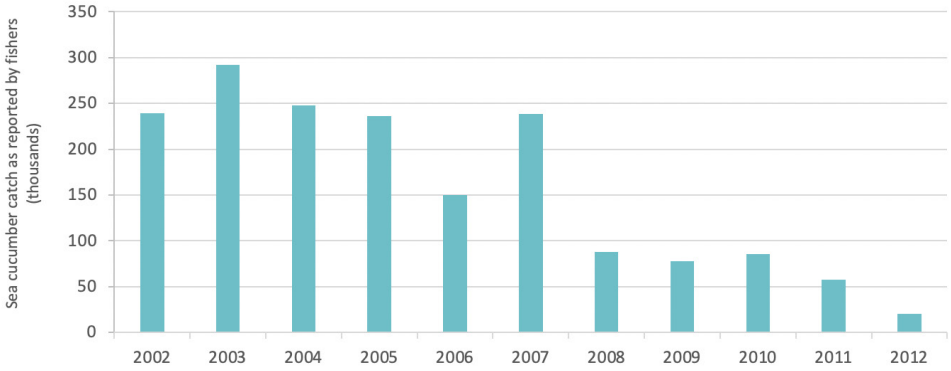
The sea cucumber (*Huifilan'daa* in Dhivehi) fishery in the Maldives is documented to have commenced in 1985 (Joseph 1992; Ahmed et al. 1997), although some fishers report that it started in the late 1970s. Initially, sea cucumbers were mainly harvested from the northern atolls, but by 1987, the fishery had expanded across the Maldives. Within a few years, the sea cucumber fishery was the most highly valued fishery outside the tuna fishing season (Joseph 1992). In the 1980s, catch was comprised mainly of high-value species, but by 1990, catch composition had changed and became dominated by the low-valued *Holothuria atra* (Lollyfish). The degree of dependence on this species reflects the poor state of the sea cucumber fishery, because fishermen previously did not harvest this species as long as higher-valued species were available (Ahmed et al. 1997).

When the fishery started, sea cucumbers were picked by hand during low tide from the intertidal region and from shallow lagoons in water <1m (Ahmed et al. 1997). As the resource became less abundant in these areas, snorkelling and

the use of other aids helped to exploit the resources in deeper waters, up to 25-15 meters. A fishing hook fixed to a block of lead and attached to a fishing line was popular in many islands. In this method, the fishermen, remaining on the surface or descending just a few meters underwater, lowers the device to hook the sea cucumber. In other cases, a pointed metal spear mounted on a long wooden pole was reported to be effective up to a depth of about 3 meters. In response to the dramatic declines in catch rates of high valued species, *Thelenota ananas* and *Holothuria nobilis*, fishermen started to use SCUBA diving gear in the collection of sea cucumber (Ahmed et al. 1997). Although this harvesting method was officially banned in 1993, the prohibition has not been effectively enforced, and SCUBA diving for sea cucumber collection still continues today.

According to a phone survey conducted in 2017 by the Ministry of Fisheries, Marine Resources and Agriculture, it was estimated that around 1,200 individuals were involved in the fishery at that time. Some fishers are exclusively involved in the sea cucumber fishery while others participate on a part-time basis. The distribution network from harvest to export and retail is complex and engages several intermediaries.

The true extent of the sea cucumber fishery in the Maldives is not yet fully understood as there is no formal mechanism to enumerate sea cucumber landings in the country. However, some information has been gathered through the fishery data collection mechanism that was established in 2002. The system then was organised such that the fishermen reported daily catches to a designated staff member at their respective Island Offices who then compiled the information into a "Monthly Fishing Report" and forwarded to the then, Statistics and Data Management Section of the Ministry (Anderson, Adam and Hafiz, 2003). This system of data reporting was gradually phased out and by around 2017, the reporting on sea cucumber fishery had stopped. Figure 2 shows the amount of sea cucumbers harvested as reported by fishers during that period.



- **Figure 2:** Sea cucumber catch rates from 2002 - 2012 as reported by islands

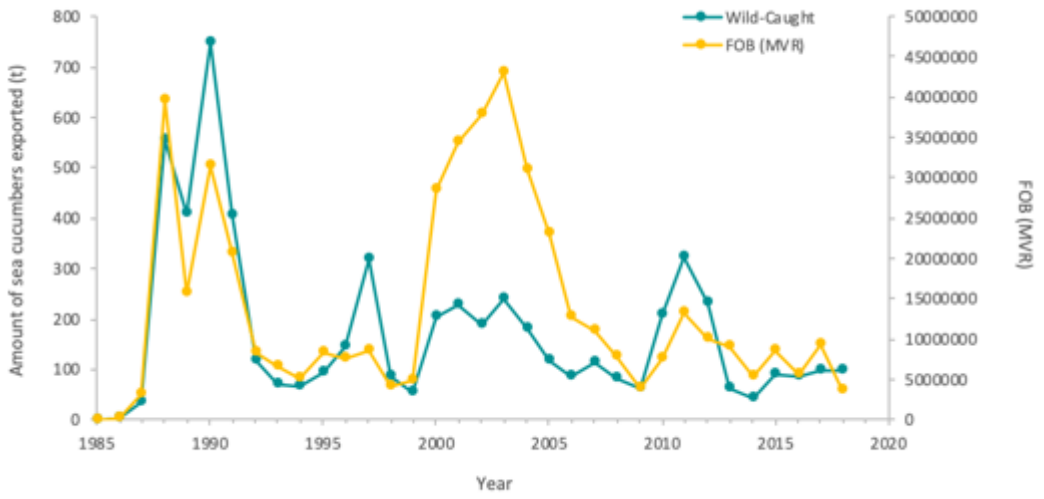
Although it is difficult to determine the extent of the sea cucumber fishery in the Maldives, since the sea cucumber industry is principally export based, the total catch removal is likely comparable to the total export quantities. However, no consistent formal records are kept by the parties involved in the sea cucumber trade, therefore it is not possible to determine harvest and export rates at the species level.

3.3 Processing & Export

Processing of sea cucumber is usually done in the fishermen's home islands or on other islands. Sometimes the cleaning of sea cucumber commences on the fishing boat itself while returning to base after a fishing trip. The initial cleaning is followed by cooking the sea cucumbers in water for 30 minutes and then burying them under sand for approximately 18-12 hours. The remaining innards are then cleaned out by performing an incision on the dorsal surface, after which it is cooked for a second time, for a period of 30 minutes. Currently utilised processing methods in the Maldives as described by parties involved in the fishery include salting after the first cook to speed up the drying process, after which the sea cucumbers are boiled for the second time to remove the salt and allowed to sun dry before they are cooked for a third time for straightening the shape of the body. Sea cucumbers lose a significant proportion of their body weight through processing.

Bêche-de-mer produced in the islands are either taken to Malé or sold to a third-party reseller (middle-man), who then supplies exporters. Some of the major exporters have agents in the islands purchasing on their behalf. In 2019, a total of nineteen parties had exported sea cucumber products from the Maldives.

Export based data is officially maintained solely by the Maldives Customs Service (MCS), documenting quantities and values declared at the time of export. The data for sea cucumber export is reported in weight of dried product and is not classified on a species level. Export data from the Maldives Customs Service shows that exports peaked in 1990 at about 745 tonnes (for MVR 31.5 million) and then experienced an overall decline over time (Figure 3). However, the revenue from sea cucumber exports began to increase starting in 2000 and peaked in 2003 at MVR 43.1 million, although the total weight of exports that year was %67.7 lower compared to that of 1990. This indicates that by the early 2000s, the export composition had changed, and sea cucumber consignments were again dominated by commercially high valued species.



- **Figure 3:** Export Data of Sea Cucumber from 1985 to 2018 (Source: Maldives Customs Services)

Throughout much of Asia, and even around the world, many high valued species of sea cucumbers such as *H. fuscogilva* and T. ananas are overexploited and their populations have been found to be severely depleted (Choo 2008). This has driven international conservation efforts that have, in turn, influenced parties such as the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) to take measures to protect such species. CITES is a multilateral treaty that regulates international trade of species under threat. In August 2019, during the 18th Conference of the Parties (CoP18), two species of sea cucumbers, namely White Teat and Black Teat, were listed in the Appendix II of the CITES. When a species is listed in the Appendix II of the CITES, the international trade in specimens of these species can only occur upon the authorisation by the country's CITES Management Authority, that is, through granting an export permit that indicates that the trading activity will not negatively impact the stock of that species. In the Maldives, this Management Authority is the Ministry of Environment.

Upon the inclusion of the two species of sea cucumbers in CITES Appendix II and based on the findings of an assessment conducted by one of the CITES Scientific Authorities of the Maldives, the Maldives Marine Research Institute (MMRI), that determined if the harvest of the species is non-detrimental to their local populations, the Management Authority had declared that export permits will not be issued for specimens of those two species harvested after 28th August 2020. The Management Authority also informed that issuance of export permits will be recommenced when adequate measures are in place to ensure sustainable management of these species and when the Scientific Authority deems that the fishery is conducted in a manner that is non-detrimental to the respective populations.

Chapter 4

Objectives and Strategies of this Plan

This management plan comprises of objectives, strategies, and actions that would contribute towards achieving the overall purpose.

The five specific objectives are:

(1) Ensure that the harvesting, processing and trading of sea cucumber is carried out through the application of principles of sustainability, ecosystem-based management and the Precautionary Approach;

(2) Prioritise evidence-based policymaking through the collection of biological, ecological, and socio-economic data on the sea cucumber fishery and associated resources;

(3) Implement a Monitoring, Control and Surveillance (MCS) mechanism and strengthen data collection and data reporting mechanisms for the sea cucumber fishery and trade;

(4) Ensure equitable benefits to all Maldivians and improve their livelihoods through decentralised development of the sea cucumber fishery and trade;

(5) Increase education and awareness amongst stakeholders and the general public.

Strategies and actions developed to achieve these objectives are summarised in Table 2.

Table 2: Breakdown of each objective by strategies, actions, timeframe and responsible parties

Objective 1	Ensure that the harvesting, processing and trading of sea cucumber is carried out through the application of principles of sustainability, ecosystem-based management and the Precautionary Approach		
Strategy	**Action**	**Time frame**	**Responsible parties**
1.1 Adopt Precautionary Approach for the management of the fishery in the absence of reliable data or full scientific certainty	1.1.1 Taking into consideration the habitats identified as crucial for feeding, shelter, spawning and recruitment, establish no-take zones for sea cucumbers to allow stocks to recover from fishing pressures	Long-term (5 – 10 years)	o MMRI o Ministry o Local councils o LGA
	1.1.2 Implement minimum harvest / export size limits for key sea cucumber species	Medium-term (3 – 5 years)	o MMRI o Ministry
	1.1.3 If and when applicable, establish input and/or output as well as export control measures for the fishery	Long-term (5 – 10 years)	o MMRI o Ministry o Maldives Customs Service
	1.1.4 Implement and enforce international transboundary restrictions for any sea cucumber species	Immediate	o MMRI o Ministry o ME o Maldives Customs Service
1.2 Promote the use of environmentally friendly gears and techniques in the sea cucumber fishery	1.2.1 Implement and enforce the restriction on the use of any fishing method or gear prohibited by the Act no.: 2019/14 (Fisheries Act of the Maldives) or any other regulations	Immediate	o MMRI o Ministry o MPS
	1.2.2 Prohibit the use of SCUBA gear in the collection and harvesting of sea cucumbers	Immediate	o Ministry o MPS o MNDF - CG
1.3 Maintain a leading role in Regional Fishery Bodies (RFBs) and relevant Intergovernmental Organisations (IGOs) in management and conservation of sea cucumbers	1.3.1 Actively participate in the scientific and management processes of SWIOFC and other relevant regional and international bodies	Immediate	o Ministry o MMRI

Objective 2	Prioritise evidence-based policymaking through the collection of biological, ecological, and socio-economic data on sea cucumber fishery and associated resources		
Strategy	**Action**	**Time frame**	**Responsible parties**
2.1 Improve data collection on biological, ecological, and socio-economic aspects of sea cucumber fishery to support evidence-based policymaking	2.1.1 Implement nationwide biological studies, size sampling, and monitoring programmes for sea cucumbers	Immediate	o MMRI
	2.1.2 Gather geographical information on fishing grounds using fishery data and field surveys in order to study the spatio-temporal exploitation patterns in sea cucumber fishery	Short-term (1 – 3 years)	o MMRI o Ministry
	2.1.3 Conduct a series of biological or ecological assessments to assess the status of *Holothuria nobilis* and *Holothuria fuscogilva*	Immediate	o MMRI
	2.1.4 Conduct a series of surveys to identify and understand socio-economic aspects of sea cucumber fishery in the Maldives	Immediate	o Ministry o Local councils o NBS
Objective 3	Implement Monitoring, Control and Surveillance and strengthen data collection and data reporting mechanisms for the sea cucumber fishery and trade		
Strategy	**Action**	**Time frame**	**Responsible parties**
3.1 Establish an effectively controlled and monitored trade flow	3.1.1 Establish licensing arrangements for commercial sea cucumber fishing vessels	Within one year of implementation of this plan	o Ministry o Local Councils
	3.1.2 Establish licensing arrangements for sea cucumber processors	Within one year of implementation of this plan	o Ministry o MFDA
	3.1.3 Establish registration arrangements in "Fisheries Information System - *Keyolhu*" for those engaged in sea cucumber fishery and trade	Within one year of implementation of this plan	o Ministry o Maldives Customs Service

3.2 Establish an efficient documentation scheme for the sea cucumber fishery	3.2.1 Establish mechanisms to collect catch and effort data from harvesters through fishery logbooks, and conduct awareness programmes to improve accuracy of data submitted by fishers	Within one year of implementation of this plan	o Ministry o Local council
	3.2.2 Require sea cucumber processors to submit purchase reports to the Ministry	Within one year of implementation of this plan	o Ministry
	3.2.3 Require export companies to maintain and submit purchase records to the Ministry	Within one year of implementation of this plan	o Ministry
	3.2.4 Require exporters to accompany an approved catch certificate with all consignments of sea cucumbers that are exported	Within one year of implementation of this plan	o Ministry o Maldives Customs Service
3.3 Establish an effective monitoring and enforcement system to ensure effective compliance to regulations related to sea cucumber fishery and trade	3.3.1 Work with other government agencies to monitor exports	Immediate	o Ministry o Maldives Customs Service o MFDA o MIRA
	3.3.2 Conduct trainings in species identification of sea cucumbers for Maldives Customs Service officials and other enforcement officers	Medium term (3 – 5 years)	o Ministry o MMRI o Maldives Customs Service
	3.3.3 Ensure compliance to regulations related to sea cucumber fishery and trade through fisheries rangers established in different regions of the country	Short-term (1 - 3 years)	o Ministry o Local councils
	3.3.4 Establish mechanisms to inspect fishing vessels, processing facilities, landing sites and airports to ensure compliance	Medium-term (3 – 5 years)	o Ministry o MMRI o Maldives Customs Service

Objective 4	Ensure equitable benefits to all Maldivians and improve their livelihoods through decentralised development of the sea cucumber fishery and trade		
Strategy	**Action**	**Time frame**	**Responsible parties**
4.1 Promote aquaculture as a means of alternative livelihood	4.1.1 Incentivise and support sea cucumber aquaculture start-ups and in doing so, prioritise fishers who are involved in sea cucumber fishery	Medium-term (3 – 5 years)	o Ministry o MMRI
	4.1.2 Establish arrangements for fingerlings / brood stocks to be easily accessible for aquaculture project start-ups	Medium-term (3 – 5 years)	o Ministry o MMRI
	4.1.3 Construct and operate multi-species hatchery and demonstration facility to facilitate aquaculture operations	Medium-term (3 – 5 years)	o Ministry o MMRI
	4.1.4 Facilitate the establishment of sea cucumber grow-out farms in island lagoons as a means of alternative livelihood for sea cucumber fishers and to provide productive gains for communities	Medium-term (3 – 5 years)	o Ministry o MMRI o Local councils
4.2 Increase profitability for sea cucumber fishing communities	4.2.1 Facilitate and encourage sea cucumber fishers to participate in existing benefit schemes that are targeted for fishers	Immediate	o Ministry
4.3 Assist in the promotion of fish products and foster new market opportunities for sea cucumber fishery and trade	4.3.1 Support the diversification of value-added sea cucumber products and foster new business opportunities to maximise economic returns to sea cucumber fishers and traders	Long-term (5 – 10 years)	o Ministry
4.4 Identify and engage stakeholders to ensure that policy decisions are made through a Participatory Approach	4.4.1 Establish, maintain, and update a fishers' registry, *Masveringe Dhaftharu*, to identify fishing communities dependent on sea cucumber resources	Immediate	o Ministry

	4.4.2 Engage with stakeholders and take their views and feedback into account in the implementation of management measures	Immediate	o Ministry
	4.4.3 Work in close liaison with key sea cucumber fishing communities, traders and the civil society	Immediate	o Ministry
Objective 5 | Increase education and awareness amongst stakeholders and the general public			
Strategy	**Action**	**Time frame**	**Responsible parties**
5.1 Promote awareness and understanding of the sea cucumber fishery in the Maldives, its contribution to the economy, and management interventions	5.1.1 Based on data availability, compile and disseminate information on: • status of resource; • fishery; • trade and exports; and • revenue to Maldives	Short-term (1 - 3 years)	o MMRI o Ministry o MoED o MIRA o Maldives Customs Service o NBS
	5.1.2 Educate fishers, traders, processors, exporters and enforcement officers about new and existing regulations via workshops, trainings and awareness campaigns	Immediate	o Ministry o MMRI o Maldives Customs Service o MPS o MNDF – CG
	5.1.3 Develop education campaigns for school children and/or the general public on the important role sea cucumbers play in marine ecosystems	Short-term (1 – 3 years)	o Ministry o MMRI o MoE
5.2 Promote appreciation for the marine environment and resources through public engagement in citizen science programmes	5.2.1 Implement a citizen science monitoring programme to collect and record photographic and observational data on sea cucumber resources	Medium-term (3 – 5 years)	o MMRI

Chapter 5

Management measures

Since there is no formal mechanism to monitor and manage the sea cucumber fishery in the Maldives, knowledge on changes in species abundance, size structures and diversity of sea cucumbers is extremely limited. Considering the fundamental roles that sea cucumbers play in supporting the overall ecosystem productivity and in the best interest of fishing communities and industry, it is critical that international best practices and timely management measures are introduced so that this resource is sustainably managed to the benefit of stakeholders and future generations. Measures that will be implemented to achieve the objectives and strategies of this Plan are summarised below.

5.1 Establishment of an Advisory Committee

An advisory committee will be established to advise the Ministry on management of billfish stocks, fishery and trade. The committee will also give recommendations to the Ministry on research and sustainable development of this fishery. The meetings of the committee will be convened at least once per year.

The committee will comprise of the following members:

(a) A Chairperson (representative of the Fisheries Department);
(b) Representative of MMRI; ;

(c) 3 (three) representatives of sea cucumber harvesters;
(d) 2 (two) representatives of sea cucumber exporters;
(e) A representative from the Ministry of Environment;
(f) A representative from the Ministry of Economic Development;
(g) A representative from Local Government Authority;
(h) A relevant locally registered NGO.

A public announcement will be made by the Ministry, calling for Expressions of Interest for the following Committee positions:

- Representatives of sea cucumber harvesters;
- Representatives of sea cucumber exporters;
- Representative from the NGO

The responsibilities of the Committee will include:

(a) Monitoring the implementation of this Plan and briefing the Minister on its progress on an annual basis;
(b) Reviewing technical and other reports pertaining to the sea cucumber fishery;
(c) Advising on management measures in response to the outcomes and recommendations from the technical reports and stakeholder workshops and consultations;
(d) Advising the Ministry on implementation of relevant regional and international management measures on a national scale; and
(e) Advising the Ministry on the implementation, monitoring and review of this Plan.

5.2 Licensing

One of the overarching aims of establishing a licensing mechanism is to identify parties that are engaged in the fishery and those who are economically dependent on the fishery resources. Such a mechanism also supports the collection and management of fisheries data. Furthermore, the licensing mechanism plays a crucial role in providing the Ministry with information that contributes towards the development of the fisheries sector and the extension of essential services to fishers.

In addition, a licensing mechanism also allows for the formal recognition of stakeholders engaged in the fishery and trade, which in turn facilitates the Ministry to safeguard their rights and ensure their social and economic security. Maintaining records of the fishing fleet and crew members, as well as information on fish processing facilities, through a licensing system assures the international community that the Maldivian fisheries are effectively and responsibly managed. Such records also serve as an important basis for planning and implementing fishery development projects.

In light of these considerations, the following parties operating within the sea cucumber fishery and trade will be required to acquire a license:

(a) All commercial fishing vessels;
(b) All commercial parties that perform any form of processing of sea cucumbers.

The general process of application for and issuance of licenses, their renewal and revocation as well as conditions of the licenses will be set forth in the relevant regulations. The Ministry will establish, maintain and update a database of licensed parties.

5.3 Data collection and Management

Collection and management of comprehensive catch and effort data and maintenance of fisheries statistics is an important measure that contributes towards assessing changes in the abundance of fish stocks in response to fishing. It also plays a critical role in ensuring that stocks are fished at

sustainable levels and that future generations continue to benefit from these resources. The fundamental tool used for this purpose is the fishery logbooks, in which catch composition, fuel usage, fishing grounds and other trip details, for each fishing trip, are recorded and submitted by the licensed vessels. Other vital information collected on the fisheries sector include details on processing and trade of fish and fishery products.

Some of this information is shared with regional and international fishery management bodies that Maldives is party to, one of which is the Indian Ocean Tuna Commission (IOTC). IOTC was established to facilitate cooperation among member states in the conservation, management and optimum utilisation of straddling fish stocks and highly migratory species in the Indian Ocean. The catch and effort data shared with IOTC informs regional fishery management decisions and will contribute towards ensuring fair and equitable allocation of fishery resources to the Maldives.

In consideration of the aforementioned factors, an integrated data collection system will be established and used to collect the following information:

- Logbook / fishery data from licensed fishing vessels;
- Purchase reports from licensed sea cucumber processors / processing facilities;
- Purchase reports from parties exporting sea cucumbers and sea cucumber products.

5.4 Prohibiting the use of SCUBA gear in the collection of sea cucumbers

The sedentary behaviour of sea cucumbers makes them extremely vulnerable to exploitation. The impact on sea cucumber populations is exacerbated by the use of SCUBA diving gear by fishers because it increases fishing efficiency by allowing fishers to stay underwater for longer periods of time and thus enabling them to take larger quantities of specimens per fishing trip. Recognising this, in 1993, the Maldives government adopted the Precautionary Approach and banned the use of SCUBA diving gear in the sea cucumber fishery. However, the prohibition was not effectively enforced, and SCUBA

diving for sea cucumber collection still continues today. In doing this, many sea cucumber harvesters dive to considerable and unsafe depths (often > 30m) and as a result, there have been many diving accidents, with several fatalities and injuries. This has been a serious health and safety concern.

It is crucial that effective management measures are implemented and enforced in order to minimise fishing impacts on wild sea cucumber stocks and to allow them to reproduce as well as to prevent the occurrence of accidents in the fishery. To this end, the Ministry will continue to maintain and enforce the current ban on the use of SCUBA diving gear in the sea cucumber fishery.

5.5 Minimising the environmental impacts from fishing and related activities

After processing sea cucumbers, the waste-water is often disposed of into the ecosystem, i.e. either in to the lagoon or onto the reef system. This waste water contains toxins that leak out from the sea cucumbers while they are being cooked, and the discharge of this water has been found to affect reef fish and bait species in the area, leading to fish mortality (Bers 2005). In order to address this, disposing of sea cucumber waste water into the lagoon or within 300 meters of the reef edge will be prohibited.

5.6 Catch certification

Catch certification is an essential instrument that helps prevent, deter and eliminate Illegal, Unreported and Unregulated (IUU) fishing. Through such a scheme, the catch is certified to have been made in accordance with applicable laws, regulations and international conservation and management measures, fully assuring consumers that the fish traded in the Maldives are sourced from a sustainably and responsibly managed fishery.

The catch certification scheme established by the Ministry will be expanded to include sea cucumber exports, and all exporters will be required to submit an approved catch certificate with all consignments of sea cucumber products. Details of the fishing vessel, date of catch as well as information on the

processing facility will also be collected through the scheme. This will help to track the flow of the product through the supply chain, ensuring product traceability at all stages, from 'hook to plate'.

5.7 Precautionary Measures

The Precautionary Approach promotes the application of timely and cost-effective measures to safeguard ecosystems and prevent irreparable damage to them, despite the lack of full scientific certainty. This approach falls within the purview of international best practices for sustainable management of natural resources (UNCED, 1982). In this regard, additional measures that are not stated in this Plan may be taken to protect and manage sea cucumber stocks. These measures may include but are not limited to the following:

(a) Declaring the closure of a specific area within Maldives and prohibiting the extraction of sea cucumbers from the no-take zone;
(b) Prohibiting the capture, processing or export of a specific species of sea cucumber;
(c) Implementing size limits and requirements of sea cucumber that can be harvested or exported;
(d) Implementing a species catch / export quota;
(e) Impose other restrictions on activities that may affect sea cucumber stocks.

Chapter 6

Implementation of this Plan

The Ministry is responsible for the implementation of each objective in this management plan, by strategies and actions, as outlined and in coordination with the relevant agencies. The Ministry shall also formulate a regulation, under the Fisheries Act of the Maldives, to implement and enforce all sea cucumber fishery management measures stated in this Plan. The Maldives Marine Research Institute shall formulate and implement a plan of action to undertake all research activities that the institute is responsible for under this Plan.

Chapter 7

Reviewing the Management Plan

This Plan will be reviewed and revised every 4 (four) years. The Ministry will ensure the engagement of sea cucumber fishing communities, licence holders, processors, exporters, civil society and other stakeholders in the review process. Where there is an immediate need to revise any part(s) or measures of this Plan, the Ministry shall carry out such revisions in consultation with the Committee.

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Annex 1: Glossary

(a) Aquaculture	Culture, propagation, keeping, raising, and ranching of aquatic living resources.
(b) Commercial fishing	Fishing or Harvesting for the purpose of obtaining a financial benefit.
(c) Enforcement officer	Any officer designated pursuant to Section 57 of the Act no.: 2019/14 (Fisheries Act of the Maldives) to enforce regulations made under the Act.
(d) Fisheries Ranger	Persons who are appointed for and by the Ministry under Act No. 2019/14 (Fisheries Act of the Maldives).
(e) Fishing / Harvesting	(1) searching for the purpose of catching, taking, killing and harvesting of fish; (2) attempting to search for, catch, take, kill or harvest fish; (3) engaging in any other activity that results in the searching, catching, taking, killing or harvesting of fish; (4) placing or searching or retaking of any fish aggregating device or equipment including "radio beacons"; (5) undertaking any operation at sea or on an island in preparation for any activity mentioned in subsections (3) ,(2) ,(1) or (4).
(f) Fishing vessels	Any type of vessel, ship or any other thing which is used for fishing, which has been prepared for fishing, or which is usually used for fishing or related activities.
(g) Logbook	Any instruments used to record data on fishing trips, including catch and effort data, submitted electronically or via any other medium determined by the Ministry.

(h) Management plans	The plan with regard to fisheries planning, management and development in relation to Chapter Three of the Act no.: 2019/14 (Fisheries Act of the Maldives).
(i) Master / Captain	Person holding the most responsible position at any given time on-board a fishing vessel.
(j) Minister	The minister responsible for fisheries, including aquaculture.
(k) Ministry	The ministry responsible for fisheries, including aquaculture.
(l) Offence	Administrative offences prescribed in this Plan.
(m) Precautionary measures	In the absence of complete information based on scientific research or where a matter has not been proved, measures adopted to manage the natural resources in a sustainable manner considering the possibility of an adverse outcome if such measures are not taken.
(n) Processing	Activities undertaken to clean, package, pack or bring any change to fish in order to preserve fish for a long period or add value to it.
(o) Processing facilities	Lands, buildings, or such other places on or in which: (1) fish or aquaculture products are cleaned, packaged, dried, salted, chilled, frozen or otherwise processed for sale in and outside the Maldives; or (2) fish or aquaculture products are stored for the purposes of packaging, canning, drying, cleaning, salting, chilling, freezing or otherwise for processing for sale in and outside the Maldives.
(p) Owner	The person who fulfils the duties and obligations of, represents as having the rights of, or accepts the obligations of, whether in personal capacity or through another person, the owner; and person or persons associated with the owner, or the manager, director or secretary of a legal entity.
(q) Food chain	A chronological pathway or order that shows the flow of energy from one organism to another.

Annex 2:
Photo identification of commonly exploited sea cucumbers in the Maldives

Details	Photo
Scientific name: *Actinopyga echinites* Common Name: Brownfish Dhivehi Name: -	
Scientific name: *Actinopyga lecanora* Common Name: Stonefish Dhivehi Name: Fili mushi / Buffulhi	
Scientific name: *Actinopyga mauritiana* Common Name: Surf Redfish Dhivehi Name: Raiy mushi	
Scientific name: *Actinopyga miliaris* Common Name: Blackfish Dhivehi Name: Kalhu mushi	

Scientific name: *Bohadschia argus*

Common Name: Leopardfish

Dhivehi Name: Summit kiru,/ Lahjehi kiru,

Scientific name: *Bohadschia vitiensis*

Common Name: Brown Sandfish

Dhivehi Name: Gaabulhaa

Scientific name: *Holothuria atra*

Common Name: Lollyfish

Dhivehi Name: Holhi

Scientific name: *Holothuria fuscogilva*

Common Name: White Teatfish

Dhivehi Name: Kan'du batu / Mas batu

Scientific name: *Holothuria fuscopunctata*

Common Name: Elephant Trunkfish

Dhivehi Name: Elephant / Van'dhukeyo

Scientific name: *Holothuria nobilis*

Common Name: Black Teatfish

Dhivehi Name: Falhu batu

Scientific name: *Bohadschia marmorata*

Common Name: Chalkfish

Dhivehi Name: Hudhu kiru

Scientific name: *Stichopus herrmanni*

Common Name: Curryfish

Dhivehi Name: Curry

Scientific name: *Stichopus chloronotus*

Common Name: Greenfish

Dhivehi Name: Kashi / Feeru

Scientific name: *Thelenota ananas*

Common Name: Prickly Redfish

Dhivehi Name: Alanaasi

Scientific name: *Thelenota anax*

Common Name: Amberfish

Dhivehi Name: Kahchala

(Photos sourced from Purcell, Samyn and Conand, 2012; Coral Reef CPR, 2016)

Ministry of Fisheries, Marine Resources & Agriculture

Malé, Maldives