PERSGA

State Of The Marine Environment Report

THE RED SEA AND GULF OF ADEN




SOMERSGA II
(2020)

STATE OF THE MARINE ENVIRONMENT

PERSGA

REPORT FOR THE RED SEA AND GULF OF ADEN : 2020

SOMERSGA II

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA)

PERSGA, *"The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden"*, is an intergovernmental organization dedicated to the conservation of the coastal and marine environments in the region. The Jeddah Convention (1982), *"the Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment"*, provides the legal foundation for PERSGA. Member states are Djibouti, Egypt, Jordan, Saudi Arabia, Somalia, Sudan, and Yemen. PERSGA was established following Cairo Declaration in 1995, and is hosted in Jeddah, Kingdom of Saudi Arabia.

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PREFACE

PERSGA initiated a Regional Process for integrated Assessment of the State of Marine Environment (SOMER) in the Red Sea and Gulf of Aden (RSGA) under the World Bank-GEF funded Strategic Action Program (SAP) and Transboundary Diagnostic Analysis (TDA) processes in 1997. The first regional report (SOMERSGA I) was prepared in 2006, following the conclusion of the SAP. SOMERSGA I was based on surveys and assessment works carried out through the TDA and SAP during late 1997 to 2004 and other relevant works carried out hitherto in the region.

More recently PERSGA has worked, through its different program and project activities, to compliment and support the regional application of the Global Ocean Assessment (GOA) Regular Process. PERSGA aims to facilitate the development and delivery of five key objectives from this process. The first objective is to provide a concise but comprehensive report to help understanding of the marine environment status and trends of change, in order to support science-based policies and decision making. The second objective is to build up regionally integrated databases to facilitate and expedite more frequent, comprehensive and regular assessments to measure progress towards delivering conservation and sustainable development. The third objective is to disseminate information on changes in the state of the marine environment to the public, in order to enhance awareness, participation and accountability towards conservation issues in the region. The fourth objective is to support networking between academia, government authorities and private sector for positive interactions. The final objective is to provide the RSGA regional contribution to the Global Ocean Assessment Regular Process for Global Reporting and Assessment of the State of the Marine Environment.

The efforts of PERSGA to improve the SOMERSGA Process included several interventions, such as capacity building workshops, provision of technical assistance to the national monitoring and surveying activities in the member states, often through regional projects and on-the-ground activities. These efforts were recently enhanced by the achievements and momentum generated by the Strategic Ecosystem Management (SEM) project, a post-SAP regional project supported by the GEF, implemented by the WB and executed by PERSGA in the region during 2014-2018. The SEM project enabled the preparation of this second State of the Marine Environment Report for the Red Sea and Gulf of Aden (SOMERSGA II).

The SOMERSGA II report follows the framework provided, under UNCLOS, in 2016 for “The First Global Integrated Marine Assessment: World Ocean Assessment I. Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects”. The intention, by PERSGA, was that the scope of SOMERSGA II should be to focus on establishing a baseline, i.e. methodologies, a set of key, objectively verifiable, quantitative, indicators, framework, etc., in order to support future more objective and effective state of marine environment reports in the region. The development of SOMERSGA II was based on wide consultative procedures involving experts and stakeholders that have enriched our understanding and improved knowledge about the state of the marine environment in our region.

As a final point, this SOMERSGA II Report aims to establish the best possible approaches and tools to be applied in future SOMERSGA considering the region’s particular biological and ecological characteristics, context, and capacity, which bear on the sustainability of the reporting process itself, whilst effectively achieving its vital role and objectives.

Prof. Ziad H. Abu Ghararah

Secretary General

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ACRONYMS

CBD	Convention on Biological Biodiversity
CITES	Convention on the International Trade in Endangered Species of Wild Fauna
CMS	Convention on the Conservation of Migratory Species of Wild Animals
DPSIR	Driver, Pressure, State, Impact, Response
EMARSGA	Emergency Mutual Aid in the Red Sea and Gulf of Aden
EMS	Environmental Management Systems
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
GOA	Global Ocean Assessment
GPA	Global Programme of Action
HEPCA	Hurghada Environmental Protection and Conservation Association
IMO	International Maritime Organisation
IOSEA	Indian Ocean and South-East Asia
ITOPF	International Tanker Owners Pollution Federation
IPAO	International Plan of Action
IUU	Illegal, Unregulated and Unreported
km	Kilometres
LBA	Land Based Activities
MARPOL	The International Convention for the Prevention of Pollution from Ships
MDG	Millennium Development Goals
MSW	Municipal Solid Waste
mt	metric tonnes
MEA	Multilateral Environmental Agreement
MPA	Marine Protected Area
MSC	Marine Stewardship Council
NDCs	Nationally Determined Contributions
NPOA	National Plan of Action
PAME	Protected Area Management Effectiveness
PERS	Port Environment Review System
PERSGA	Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden
POPs	Persistent Organic Pollutants
PSSAs	Particularly Sensitive Sea Areas (under MARPOL)

RSGA	Red Sea and Gulf of Aden
SAP	Strategic Action Plan
SDG	Sustainable Development Goal
SEM	Strategic Ecosystem Management
SOMER	State of the Marine Environment Report
SOMERSGA	State of the Marine Environment for the Red Sea and Gulf of Aden
TDA	Transboundary Diagnostic Anaysis
TOT	Training of Trainers
UN	United Nations
UNCLOS	United Nations Convention on the Law Of the Sea
UNE	United Nations Environment
UNEP	United Nations Environment Programme
UNGA	United Nations General Assembly
WHS	World Heritage Site
YLNGC	Yemen Liquid Natural Gas Company

PART I SUMMARY

Mandate:

The mandate for production of this second State of the Marine Environment Report for the Red Sea and Gulf of Aden (SOMERSGA II), by the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA) is provided by Article XVIII(f) of the Jeddah Convention (PERSGA, 1982a).

Area covered:

The geographic coverage is provided by Article II of the Jeddah Convention.

Key approach and methodologies:

The first Red Sea and Gulf of Aden state of the marine environment (SOMER RSGA) report was produced in 2006 (PERSGA, 2006). Since then a "*World Ocean Assessment (WOA) Regular Process"* has commenced under the United Nations Convention on the Law of the Sea (UNCLOS). The latest report from this process is dated 2016 (UNGA, 2016).

The second RSGA SOMER report, hereinafter referred to as SOMERSGA II aims, whilst recognising the local context, to conform with the UNCLOS "regular" process. The key objective of SOMERSGA II is to start to regularise a set of key, objectively verifiable, quantitative, indicators to support future more objective and effective RSGA SOMER reporting under SOMERSGA III proposed to be delivered in 2025.

The local context includes a limited capacity to report and monitor; a limited regularised, and objective, baseline and regular/standardised monitoring against this baseline; and the lack of recent information on the marine environment for Yemen and Somalia.

The criteria for the selection of objective indicators for SOMERSGA II were: (1) Relevance to the Chapter structure of the UNCLOS regular process; (2) Relevance to the region; (3) Relevance to Agenda 2030, particularly Sustainable Development Goal (SDG) 14 (UNGA, 2015); and (4) Access to, and availability of, information.

A list of 37 key objective SOMERSGA II indicators were proposed to 15 regional/thematic experts supported by relevant PERSGA staff experts in a SOMERSGA II workshop in Jeddah in October 2018. Participants in the workshop agreed the 37 proposed indicators and ADDED an additional 4 indicators making a total 41 indicators.

Status:

Table1 below provides a summary assessment of the overall status of SOMERSGA II indicators for which there is sufficient information. Sufficient information is not available for a significant number of the proposed indicators and this information will need to be obtained and evaluated for the next SOMERSGA report, SOMERSGA III, proposed to be delivered in 2025.

Table 1: Summary assessment of the overall status of SOMERSGA II indicators

SOMER II INDICATOR	SOMER II SCORE			
	Weight	Rank	Trend	Total
Live hard coral cover (year, site, % cover)	9.2	1	1	**9.2**
Marine biodiversity protected area (year/km²)*	8.87	2	1	**8.87**
Population of the coastal zone (town/city)	8.8	3	-1	**-8.8**
Marine litter (year/site/occurrence)	8.8	3		
Mangrove (year/site/km²)	8.8	3	0	**0**
Chlorophyll A values (year/site/value)	8.2	4		
Zero wastewater discharge practice (year/country)	8.13	5		
Oil spills (year/site/tonnes)	8	6	?	?
pH high accuracy (year/site/pH)	7.87	7		
Whale shark (year/site/number)	7.87	7	?	**?**
Wastewater treatment (year/site/m³)	7.67	8		
Grouper (year/site/number)	7.64	9		
Napoleon wrasse (year/site/number)	7.57	10		
MPA PAME (year/MPA/score)	7.4	11	1	**7.4**
Coral bleaching (year/site/%)	7.4	11		
Dugong (year/site/number)	7.4	11	?	**?**
Ballast water reception (year/site/m³)	7.33	12		
Marine Fish Landings (year/site/tonnes)	7.27	13	-1	**-7.27**
Ratified multilateral environmental agreements (year/number)	7.2	14	1	**7.2**
Solid waste coastal cleanup (year/site/tonnes)	7.07	15		
Solid waste production (year/site/tonnes)	7	16		
Waste oil reception (year/sites/tonnes)	7	16		
Turtle nests (year/site/number)	6.93	17	?	**?**
Marine aquaculture (year/site/tonnes)	6.93	17		
Hammerhead aggregations (year/site/number)	6.87	18		
POPs in marine fish (year/site/value)	6.8	19		
Certified coastal/marine nature tourism guides (year/site/number)	6.8	19		
Manta ray (year/site/number)	6.8	19		
Red Sea shipping (year/transit-delivery/tonnage)	6.79	20	-1	**-6.79**
Desalination capacity (year/site/m³)	6.73	21	-1	**-6.73**
Registered dive boats (year/site/number)	6.53	22		
Butterflyfish (year/site/number)	6.5	23		
Blue flag beaches (year/site/number)	6.47	24	1	**6.47**
Managed landfill sites (year/site/tonnage)	6.47	24		
Hard coral planted (year/site/km²)	6.36	25		
Clownfish (year/site/number)	6.3	26		
EMS accredited Ports (year/site/tonnage)	6	27		
Osprey nests (year/site/number)	5.93	28		
Fisher association membership (year/organisation/number)	5.73	29		
Mangrove planted (year/site/km²)	5.5	30		
MSC certified wild fisheries (year/fishery)	4.69	31	0	**0**

* "Coastal" areas are not included/defined

Total	293.62	Weight x trend	9.55

Key	improving «+1»	«0» unchanged	«-1» deteriorating	Data deficient ?	Not analysed

The total SOMERSGA II score achieved is obtained by multiplying the environmental significance "**weight**" value by the change "**trend**" value for each indicator and summing for all indicators. The environmental significance "**weight**" was specified for each indicator (maximum 10, minimum 0) by the participants of the SOMERSGA II workshop in Jeddah in October 2018.

The change "trend" score ("+1" improving, "0" unchanged and "-1" deteriorating) was determined by the change in indicator value from a baseline year, or group of years, to a more recent year or group of years (see the individual indicator assessments).

Assuming all indicator values were to show a trend of environmental improvement "+1" then the total possible SOMERSGA II environmental improvement score for all indicators would be 293.62.

The box below presents the overall SOMERSGA II status for those indicators that have been evaluated.

OVERALL SOMERSGA II TREND (2006-2018)	 (1)
The SOMERSGA II score, for those indicators that have been evaluated, shows an overall trend of environmental improvement of 9.55 or approximately 3.25% of the possible total.	

However, this indicated improvement should not be viewed with complacency because:

(1) many SOMERSGA indicators lack information on their status; (2) of the lag between the rapid pace of coastal development and the introduction of effective environmental management and; (3) the predicted incremental and increasing frequency of negative climate change impacts in the coming decades.

Key issues, in respect of SOMERSGA II reporting and preparing for SOMERSGA III proposed to be due in 2025, are presented in the box below:

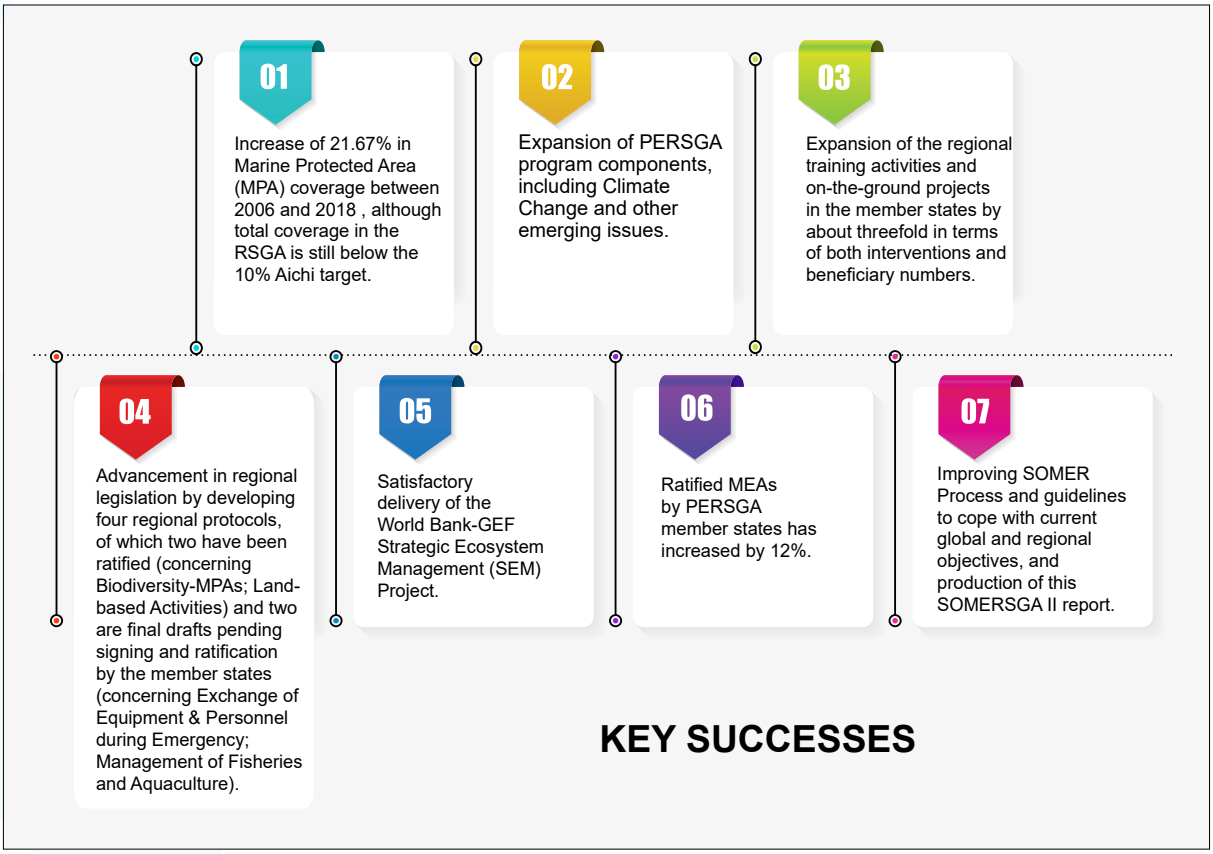
KEY ISSUES	 (2)

1. **Identifying, and agreeing, key indicators for SOMERSGA III including social, economic and environmental indicators of RSGA "Ocean" value to humans.**
2. **Providing objective and quantitative information on key SOMERSGA III indicators**
3. **Climate change (global warming and ocean acidification)**
4. **Urban and tourism development (encroachment, recreational use)**
5. **Reduce, reuse, recycle (pollution, renewable energy, waste management)**
6. **Fisheries governance (Illegal, Unreported and Unregulated fishing - IUU)**
7. **Protected areas governance (protected area management effectiveness - PAME)**

(1) Icon made by https://www.flaticon.com/authors/gregor-cresnar from www.flaticon.com

(2) Icon made by https://www.flaticon.com/authors/gregor-cresnar from www.flaticon.com

Key successes during the SOMERSGA II review period are presented in the box below:



Key recommendations in respect of preparing for SOMERSGA III, proposed to be due in 2025, are presented in the box below.

KEY RECOMMENDATIONS

1. **PERSGA should facilitate the identification of, and signatories to the Jeddah Convention should formally agree, indicators and attributes for the objective and quantitative verification of key SOMERSGA III indicators for SOMERSGA III[3].**
2. **PERSGA should provide means of quantitative and objective verification for the indicators identified in 1 above, to meet the SOMERSGA II data format.**
3. **PERSGA should help strengthen national capacity to provide information on the indicator(s) identified from 1 above, according to the requirements specified in 2 above.**
4. **PERSGA should, through national focal points, contact relevant parties in the RSGA to provide information according to 3 above.**
5. **PERSGA should deliver a SOMERSGA III report to include an assessment of the implementation of recommendations 1 through 4 by the end of 2025.**

(3) Taking note of objectively verifiable indicators specified in the UNCLOS GOA SOMER. Where a proposed indicator is relevant to the Jeddah Convention LBAs, and/or Protected Areas Protocols it should be considered for inclusion in annexes to these Protocols and other current and proposed Jeddah Convention Protocols as relevant.

PART II THE CONTEXT OF THE ASSESSMENT

Chapter 1: Introduction – Planet, Oceans and Life

"*Introduction – Planet, Oceans and Life*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

No SOMERSGA II indicator has been proposed for "*Introduction – Planet, Oceans and and Life.*"

The Gulf of Aden is an integral part of the Indian Ocean with its oceanography primarily influenced by the Somali current. The Red Sea is a semi-enclosed young ocean with net inflow of water from the Gulf of Aden through the Bab al Mandeb. Water currents are driven by these inflows from the Gulf of Aden, evaporation and surface winds. The climate is arid and freshwater inflows are limited to patchily distributed groundwater seepage and occasional local flash floods. The salinity is, consequently, relatively high and the waters relatively nutrient poor. The Red Sea is characterised by low tidal ranges and the mean-sea-level is slightly higher in the winter than in the summer. These characteristics mean that mangrove and salt marshes are relatively limited in extent. Coral reefs and seagrass beds are well developed. A high percentage of species, particularly fish species, found in the Red Sea are endemic (only found in the Red Sea), (PERSGA, 2006). A recent review by Bogorodsky and Randall (2019) indicated that the percentage of endemic Red Sea fishes is 14.6%, which ranks the Red Sea among the top three areas of high fish endemism in the world, the others being the Hawaiian Islands and Easter Island.

Figure 1. Klunzinger's Wrasse (Thalassoma rueppellii), a Red Sea endemic fish species (Credit Maher Amer).

Chapter 2: Mandate, Information Sources and Method of Work

"*Mandate, Information Sources and Method of Work*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

No SOMERSGA II indicator has been proposed for "*Mandate, Information Sources and Method of Work.*

2.1 Mandate

The mandate for production of SOMERSGA II, by the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), is provided by Article XVIII(f) of the Jeddah Convention (PERSGA, 1982a) which specifies that one of 17 duties and functions of the Council is "*To review and evaluate the state of the marine environment and coastal areas*

on the basis of reports provided by the Contracting Parties, or by the international organizations concerned".

2.2 Geographic Coverage

The geographic coverage is provided by Article II of the Jeddah Convention (PERSGA, 1982a).

2.3 Key approach and methodology

The first Red Sea and Gulf of Aden State of the Marine Environment (RSGA SOMER) report was produced in 2006 (PERSGA, 2006). Since then a "*World Ocean Assessment (WOA) Regular Process* has commenced under the United Nations Convention on the Law of the Sea (UNCLOS). The latest report from this process is dated 2016 (UNGA, 2016).

The second RSGA SOMER report, hereinafter referred to as SOMERSGA II aims, whilst recognising the local context, to conform with the UNCLOS "*regular*" process. The key objective of SOMERSGA II is to start to regularise a set of key, objectively verifiable, and quantifiable, indicators to support future more objective and effective RSGA SOMER reporting under SOMERSGA III.

The local context includes a limited capacity to report and monitor; a limited regularised, and objective, baseline and regular/standardised monitoring against this baseline; and the lack of recent information on the marine environment for Yemen and Somalia.

The criteria for the selection of objective indicators for SOMERSGA II were: (1) Relevance to the Chapter structure of the UNCLOS regular procees; (2) Relevance to the region; (3) Relevance to Agenda 2030, particularly Sustainable Development Goal (SDG) 14 (UNGA, 2015); and (4) Access to, and availability of, information.

A list of 37 key objective SOMERSGA II indicators were proposed to 15 regional/thematic experts supported by relevant PERSGA staff experts in a SOMERSGA II workshop in Jeddah in October 2018. Participants in the workshop agreed, and prioritised, the 37 proposed indicators and ADDED an additional 4 indicators making a total 41 indicators.

A questionnaire was completed for each indicator by each participant. The questionnaire included opportunity to specify subjectively: (a) an environmental weighting from 0-10 for each proposed indicator; (b) the availability of information on the status if the indicator before the year 2000, between 2000 and 2006 and for 2017 through 2018; and (c) the status of the indicator - improving, deteriorating or stable in 2017-2018.

A standard format for providing information on the status of each indicator was presented. Key attributes required for each record include: (a) the name of the indicator; (b) the unit of measurement; (c) a numeric value; (d) the location of measurement (latitude, longitude in degrees decimal degrees and the height/depth of measurement relative to mean sea-level in meters); (e) the date and time of each measurement; (f) an attribution for the information (a named personal communication or document).

Such information as has been obtained in support of the SOMERSGA II is documented in an MS Access database (PERSGA, 2019a) and google earth kmz file (PERSGA, 2019b).

A legal requirement for developers and users of coastal and marine natural resources to monitor and report on the status of these indicators should enable and catalyse capacity building in monitoring and reporting.

Key recommendations in respect of preparing for SOMERSGA III, proposed to be due in 2025, are presented in the box in Part I.

PART III ASSESSMENT OF MAJOR ECOSYSTEM SERVICES FROM THE MARINE ENVIRONMENT (OTHER THAN PROVISIONING SERVICES)

Chapter 3: Scientific understanding of ecosystem services

"*Scientific understanding of ecosystem services*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

No SOMERSGA II indicator has been proposed for "*Scientific understanding of ecosystem services.*"

A key catalyst for improving the scientific understanding of ecosystem services within the RSGA region was the GEF Full Size Project with the title '*Strategic Ecosystem Based Management of the Red Sea and Gulf of Aden' (SEM), (Rouphael, A., 2018)*. The "SEM Project" commenced in November 2013 and ended in December 2018.

The objective/overall outcome of the Project was to "*improve management of selected marine protected areas by local communities and strengthen information sharing between PERSGA member countries*". Production of this SOMERSGA II report largely builds on this information sharing theme.

The SEM Project was executed by PERSGA with funding and technical support from the World Bank and Global Environmental Facility (GEF). The SEM Project had concurrent activities in Djibouti, Sudan, Egypt and Jordan, and Project coordination activities in Saudi Arabia. The efficacy, relevance, effectiveness, efficiency and sustainability of the SEM Project were all rated as high, whilst the overall outcome of the Project was assessed as satisfactory by the independent evaluation consultant *(Rouphael, A., 2018)*.

Figure 2. Qulaan ecovillage at Wadi el Gemal National Park, Egypt (credit PERSGA)

Some key success stories of the SEM Project included:

- World Heritage nomination of the combined Dungonab Bay and Sanganeb National Parks, Sudan (see Figure 4).
- Empowerment of women and vulnerable fishing communities.
- Triggering process of revision of national fisheries legislation in member countries.
- Development of a regional protocol concerning management of fisheries and aquaculture in the Red Sea and Gulf of Aden.
- Qula'an Eco-village at Wadi El-Gemal Hamata National Park, Egypt (Fig 2).
- Moucha-Maskali Island Fisher Centre, Djibouti (Fig 3).
- Strengthened MPA awareness and management.
- Strengthened the Regional Monitoring Network of PERSGA.

Figure 3. Fisher's center at Mucha Maskali Islands National Park, Djibouti (credit PERSGA).

Given the lack of SOMERSGA II indicators for "*Scientific understanding of ecosystem services*" it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Figure 4. PERSGA/GEF (2018) Final Draft Integrated Management Plan for the UNESCO World Heritage Site for Dungonab Bay & Mukkawar Island and Sanganeb Atoll Marine National Park, Sudan (2017 to 2021). Volume I Current Conditions, and Volume II Operations Manual. Prepared under the World Bank GEF funded Strategic Ecosystem Management (SEM) for the Red Sea and Gulf of Aden Project. 234p

Chapter 4: The Ocean's Role in the Hydrological Cycle

"The Ocean's Role in the Hydrological Cycle" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

No SOMERSGA II indicator has been proposed for "*The Ocean's Role in the Hydrological Cycle.*"

The Red Sea is a semi-enclosed sea with low rainfall and freshwater run-off/groundwater seepage from the land although occasional, but significant, flash floods can occur locally. The Red Sea consequently has a relatively high salinity. It is maintained by net water inflows from the Indian Ocean and does not contribute, significantly, to other ocean systems. The Gulf of Aden is subject to a seasonal upwelling caused by the Somali current which increases local rainfall, nutrient inputs, and ecological production.

Recommendations

Given the lack of SOMERSGA II indicators for "*The Ocean's Role in the Hydrological Cycle*" it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 5: Sea/Air interaction

"*Sea/Air interaction*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016)

No SOMERSGA II indicator has been proposed for "*Sea/Air interaction.*"

The Red Sea and Gulf of Aden are influenced by, but do not significantly contribute to, wider atmospheric effects. These wider atmospheric effects include those resulting from elevated greenhouse gasses. Localised extreme weather events include occasional flash floods.

Recommendations

Given the lack of SOMERSGA II indicators for "Sea/Air interaction" it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 6: Primary Production, Cycling of Nutrients, Surface layer and Plankton

"*Primary Production, Cycling of Nutrients, Surface layer and Plankton*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016). Nutrients are also indicated as a key contaminant/source category in the Global Programme of Action (GPA) for the protection of the marine environment from land-based sources (UNEP, 1995) which is referred to in the Jeddah Convention "Protocol Concerning the Protection of the Marine Environment from Land Based Activities" (PERSGA, 2005a).

The Red Sea is a semi-enclosed sea with relatively limited nutrient inputs either from the land or from water exchange with the Indian Ocean[4]. Vertical mixing is also somewhat limited. The waters of the Red Sea are consequently relatively nutrient poor. The Gulf of Aden is subject to a seasonal upwelling caused by the Somali current which increases local rainfall, nutrient inputs, and ecological production.

The SOMERSGA II indicator "*Chlorophyll a*" described in Chapter 20 has high relevance as an indicator of "*Primary Production, Cycling of Nutrients, Surface layer and Plankton.*"

Recommendations

Given the lack of SOMERSGA II indicators for "*Primary Production, Cycling of Nutrients, Surface layer and Plankton"* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 7: Calcium Carbonate Production and Contribution to Coastal Sediments

"*Calcium Carbonate Production and Contribution to Coastal Sediments*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016). Sediment mobilization is indicated as a key contaminant/source category

(4) See chapter (20)

in the Global Programme of Action (GPA) for the protection of the marine environment from land-based sources (UNEP, 1995) which is referred to in the Jeddah Convention "Protocol Concerning the Protection of the Marine Environment from Land Based Activities" (PERSGA, 2005a).

Much of the shallow water areas of the Red Sea and Gulf of Aden contain living coral reefs with consequently high calcium carbonate production. This production has local significance for beaches, sand flats and dune areas that, in turn, can support turtle and bird nesting and recreational use.

The SOMERSGA II indicator "Live Hard Coral Cover" is described in Chapter 43 and relates to "*Calcium Carbonate Production and Contribution to Coastal Sediments*".

Recommendations

Given the lack of SOMERSGA II indicators for "*Calcium Carbonate Production and Contribution to Coastal Sediments"* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 8: Aesthetic, Cultural, Religious and Spiritual Ecosystem Services Derived from the Marine Environment

"*Aesthetic, Cultural, Religious and Spiritual Ecosystem Services Derived from the Marine Environment*" is a chapter title under theWorld Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

The Red Sea and Gulf of Aden are traditional trading, and pilgrimage, routes with associated settlements, farming, where freshwater is available, and fishing. Historically the Red Sea and Gulf of Aden were a significant source of turtle (tortoise) shell and mother of pearl although this activity is now very rare. The Ports of Suakin in Sudan, and Jeddah in Saudi Arabia contain World Heritage Sites reflecting this trading heritage. A number of other historic sites could require protection(5).

In recent years the coastal areas have become increasingly urbanised with a strong drive to expand coastal tourism and recreation particularly in Egypt and Jordan and plans to expand coastal tourism in the Saudi Arabian Red Sea.

The SOMERSGA II indicator "*Population of the Coastal Zone*" is described in this Chapter.

Recommendations

Given the lack of SOMERSGA II indicators for "*Aesthetic, Cultural, Religious and Spiritual Ecosystem Services Derived from the Marine Environment"* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and *their means of objective and quantitative verification.*

8.1 Population of the coastal zone

Population of the coastal zone is a SOMERSGA II indicator. This indicator was ranked 3rd out of 31 for 41 indicators with an environmental weighting of 8.8 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

An increasing coastal population has adverse consequences on the RSGA SOMER by increasing demand for resources such as food, water and energy, loss of natural habitat to infrastructure, and solid, liquid and atmospheric, pollution. A number of these adverse environmental consequences,

(5) https://www.ancientportsantiques.com/the-catalogue/red-sea/

and the management of these consequences, are assessed through other SOMERSGA II indicators.

The definition of the coastal zone is highly variable. In addition, demographic statistics tend to cluster population by human settlement. The approach is, therefore, to compare population growth in major urbanised areas such as towns and cities.

The following summarises the best estimate of population increase for major RSGA coastal towns/ cities for which information is available:

SOMERSGA II INDICATOR 40: POPULATION OF THE COASTAL ZONE

Djibouti, Djibouti City: **27%** between 2009 (475,322 - http://data.un.org) and 2018 (603,900 - http://www.citypopulation.de)
Jordan, Aqaba: **61%** between 2006 (117,000) and 2015 (188,160) – http://data.un.org.
Egypt, Hurghada: **287%** between 2006 (160,000) and 2019 (estimated 461,643) – http://population.city
Suez: **42%** between 2006 (512,135) and 2017 (728,180) - http://data.un.org
Saudi Arabia, Jeddah: **22%** between 2004 (2,801,480) and 2010 (3,430,697) - http://data.un.org.
Yanbu-al-Bahr: **24%** between 2004 (188,430) and 2010 (233,240) - http://data.un.org.
Jizan: 24% between 2004 (100,694) and 2010 (127,743) - http://data.un.org.
Somalia, Berbera: No information
Sudan, Port-Sudan[6]**:** 918% since 1956 and 23% in the last 10 years (48,000 in 1956, 135,000 in 1973, 213,000 in 1983, 308,000 in 1993, 399,000 in 2008 (population censuses); 489,725 in 2019 (estimate))
Yemen, Aden: 31% between 2004 (589,419 - http://data.un.org) and 2013 (773,510 - https://knoema.com)
Hodeidah: No information

Unfortunately, quantitative and objective information on the population of towns and cities in the RSGA has been difficult to source and verify for SOMERSGA II with different sources sometimes giving different population sizes for the same time period. A key source of information is the UN web site "*data.un.org*" which is based on national census data. Recent information is limited on the web site.

An increasing population in the coastal zone is likely, without effective environmental management, to lead to deterioration of environmental quality and to increase risk from extreme events.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "*Population of the Coastal Zone",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

(6) http://habitat3.org/wp-content/uploads/Sudan-National-Report.pdf

Chapter 9: Conclusions on Major Ecosystem Services Other than Provisioning Services

"Conclusions on Major Ecosystem Services Other than Provisioning Services" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

"*Conclusions on Major Ecosystem Services Other than Provisioning Services"* comprise conclusions on the status of the indicators assessed in Part III "*Assessment of Major Ecosystem Services from the Marine Environment*" presented in Chapters 3 through 8 of this SOMERSGA II report as described above.

The Red Sea and Gulf of Aden ecosystem services could be globally significant in respect of the genetic thermal resilience of their reef building corals. Of course, this, and other ecosystem services, have high local significance.

Unfortunately, the information needed to determine the status of Part III indicators for the SOMERSGA II is relatively limited. Any conclusions that can be drawn are presented in the Summary in Part I and in Chapter 54 of this SOMERSGA II report.

PART IV ASSESSMENT OF THE CROSS-CUTTING ISSUES: FOOD SECURITY AND FOOD SAFETY

Chapter 10: The Oceans and Seas as Sources of Food

"The Oceans and Seas as Sources of Food" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

The Red Sea and Gulf of Aden fisheries are not significant **globally** in terms of food security and food safety. Traditionally coastal populations, in the RSGA, have depended more on agriculture and animal husbandry for protein than on the sea. However, there are coastal fisher communities that depend, to a significant extent, on sea-based fisheries for their livelihoods (Fig 5).

The Gulf of Aden is relatively productive, but access is currently restricted due to security concerns. The Red Sea is relatively less productive but has locally significant fisheries.

There is an increasing demand for capture and culture fisheries in the Red Sea and Gulf of Aden to meet the demands of locally increasing urban populations, the tourism sector, and also, to supply demand from markets outside the region.

SOMERSGA II indicators of high relevance to this chapter *are presented under Part IV Chapters 11 through 15 below.*

Figure 5. Fishing boat at Dungonab Village (Credit Maher Amer)

Recommendations

Given that there may be other objective and quantifiable indicators in support of an assessment of the state of "The Oceans and Seas as Sources of Food" to those presented in Chapters 11 through 15, it is recommended for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 11: Capture Fisheries

"*Capture fisheries*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

Commercial capture fisheries include shrimp that are bottom trawled, open water fisheries, including tuna and tuna-like species, that are line and net fished. In addition, there are semi-commercial, artisanal and subsistence fisheries that fish on coral reefs using hook and line and occasionally traps.

In some reports, it is indicated, based on various production assumptions, that wild-caught fish stocks are generally underexploited in the RSGA. Such a general statement should be viewed with caution and should not be assumed for all target stocks, particularly those, like grouper, that migrate to spawn (Dawson Shepherd A., 2015).

"*Marine fish landings*" and "*MSC certified fisheries"* are specified as SOMERSGA II indicators and are described below under this Chapter.

Recommendations

Given that there may be other objective and quantifiable indicators in support of an assessment of the state of "Capture fisheries" to those presented below, it is recommended for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

11.1 Marine Fish Landings - wild caught

"Marine fish landings" (wild caught) in tonnes is a SOMERSGA II indicator. This indicator was ranked 13th out of 31 for 41 indicators with an environmental weighting of 7.27 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Unfortunately, quantitative and objective information on wild caught "Marine fish landings" has not been sourced for SOMERSGA II. Whilst some information is available (see below) it is not considered to be accurate. Hopefully this information will be improved for SOMERSGA III. Substantial investment will be needed to introduce a quantitative and objective system for determining, and reporting on, wild caught marine fish landings. In addition, the focus should be on "Catch per unit effort" since change in catch per unit effort over time gives a much better indication of the status of a fish stock than marine fish landings.

Total reported landings from the Red Sea and Gulf of Aden have increased since 1950, reaching a peak of around 400,000 metric tonnes (mt) in 2004/2005. However, total landings then fell to 280,000 tons in 2008, driven by a decline in landings in Yemen, which is the major source of marine fish landings amongst PERSGA countries (figure 6).

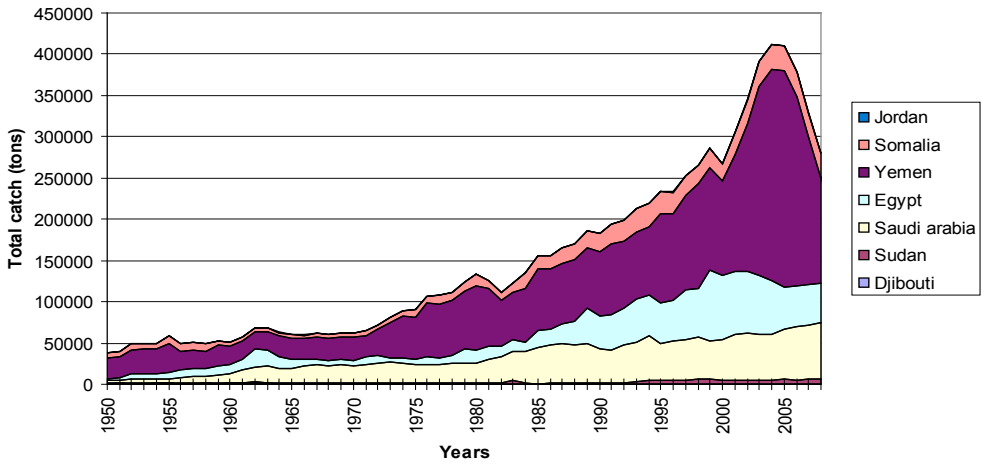


Figure 6. Total marine fish catches in PERSGA countries (1950-2008). Source: FAO statistics.

The reported decreasing trend could be considered as a concern, taking into account the Stock-Catch Status assessments provided by some studies based on years prior to 2005 (Heileman and Mistafa 2008). These studies indicated an increase in percentage of catches from collapsed and overexploited fish stocks. However, some reports attributed the decline in Yemeni catches to decreasing fishing activities(7).

The previous SOMERSGA in 2006 reported declines in fish landings that could indicate fish stock declines including: regional stocks of sharks; cuttlefish and deep sea lobsters in the Gulf of Aden by industrial trawlers; shrimp stocks and other living marine resources (via the large net fishing by-catch of non-target species such as turtles, dugong and dolphins which are almost invariably discarded as dead) and the catches of Indian mackerel, kingfish, sharks, cuttlefish, shrimp, rock-lobster and trochus (PERSGA, 2006). Conversely the overall prevalence of bycatch and discards

(7) World Bank Group Yemen 2009, Published in Yemen Times Update: 15-07-2010 Issue No. 1389

and destructive fishing practices is considered to be limited in the region (UNEP, 2005).

There is a mixed message concerning the status of fish stocks in the RSGA to 2006 although a declining trend is suggested (Tesfamichael, D., 2012). Feedback from fishers through the SEM Project is suggestive of a continuing decline after 2008 although objective data in support of this are limited. This background together with the precautionary approach have been used to suggest that fisheries in the RSGA have continued to decline between 2008 and 2018 particularly in terms of catch per unit effort.

Recommendations

Given the lack of accurate information available for SOMERSGA II on the indicator "*Marine fish landings*", with a focus on "*Catch per unit effort*", and the need for other indicators to assess impacts of fisheries, such as bycatch and on not-target species, it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

11.2 MSC certified fisheries

Background

Marine Stewardship Council (MSC) certified fisheries is a SOMERSGA II indicator. Marine Stewardship Council (MSC) certification is an international initiative supported by the food retail sector designed to secure the sustainability, and consequently, the supply chain, of wild capture fisheries. Fisheries that have obtained MSC Certification can label their products with the MSC kite mark (Fig 7).

The MSC Fisheries Standard has three core principles that every certified fishery must meet: (1) Sustainable Fish Stocks; (2) Minimising Environmental Impact; (3) Effective Management[8].

The MSC Certified Fisheries indicator was ranked 31st of 31 for 41 indicators with a low environmental weighting of 4.69 out of 10 at the Jeddah SOMERSGA II workshop in October 2018. Despite this low ranking it should be noted that an increase in the number of MSC Certified Fisheries should both directly, and indirectly, contribute to improvement of the state of the marine environment in the RSGA.

Figure7. MSC certified skipjack tuna fishery in the Maldives. Jauhary, R., 12/04/2017.

Methodology

The MSC website provides a map (see figure 8) showing all fisheries that are currently MSC certified, or being considered for, MSC certification. The methodology for identifying this SOMERSGA II indicator involves checking the map within the RSGA region for MSC certified fisheries and noting the details.

Status

Figure 9 below summarises the status of MSC certified fisheries in the RSGA. **No** fisheries in the RSGA region had achieved MSC certification at the time of publication of SOMERSGA II. In addition, as far as can be determined, no fishery in the RSGA is seeking MSC certification.

(8) https://www.msc.org/standards-and-certification/fisheries-standard

Figure 8. Map of MSC monitored fisheries available from/courtesy of https://www.msc.org

Key sites

No key sites are identified since there are no examples of MSC certified fisheries in the Red Sea and Gulf of Aden. However, by identifying this situation it is to be hoped that this will result in efforts to deliver some MSC fisheries certification in the RSGA by the time of SOMERSGA III.

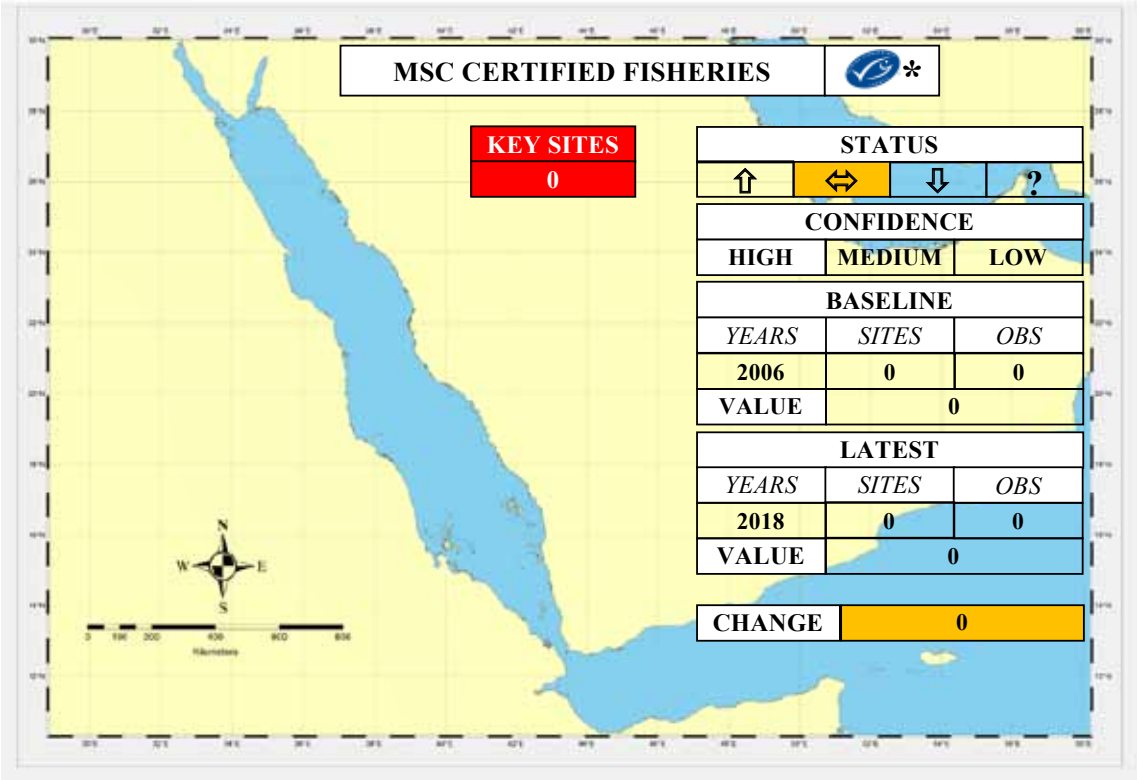


*Figure 9: Status of SOMERSGA indicator - Marine Stewardship Council Certified Fisheries (*icon courtesy of https://www.msc.org/)*

Recommendations

The MSC website provides information on the status of the SOMERSGA II indicator "MSC certified fisheries" to which reference should be made. In addition:

1. Signatories of the Jeddah Convention should facilitate and encourage delivery of MSC certified fisheries in the RSGA so as to improve the SOMER of fisheries specifically and the SOMER of the RSGA generally.
2. PERSGA member states should accelerate steps towards signing and ratification of the final draft of the "Regional Protocol Concerning Cooperation in Management of Marine Fisheries and Aquaculture" developed in 2017.
3. PERSGA should deliver a SOMERSGA III report to include an assessment of delivery of the recommendations and 2 above by the end of 2025.

Chapter 12: Aquaculture

"*Aquaculture*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

Marine Aquaculture has been specified as a SOMERSGA II indicator.

There is virtually no freshwater aquaculture production in the RSGA coastal region. "*Marine Aquaculture*" production in tonnes was ranked 17th out of 31 for 41 indicators with an environmental weighting of 6.93 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

There has been significant investment in marine/brackish water shrimp aquaculture, particularly in the Saudi Arabian Red Sea in the recent past, as well as planning to establish aquaculture projects in Djibouti, Sudan and Yemen.

Unfortunately, quantitative and objective information on marine aquaculture production has not been sourced for SOMERSGA II. Whilst some information is available it is not considered that it is very accurate. Hopefully this information will be forthcoming for SOMERSGA III.

Substantial investment will be needed to introduce a quantitative and objective system for determining, and reporting on, marine aquaculture production. Issues include: (1) Climate change risk and vulnerability, resilience and adaptation; (2) obtaining brood stock; (3) managing disease; (4) controlling pollution; (5) providing feed; (6) economic viability in competition with suppliers outside the region.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "Aquaculture", it is recommended, taking note of the above suggestions, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 13: Fish Stock Propagation

"*Fish stock propagation*" (the re-introduction of fish into the wild to restock wild fisheries), is a chapter title under the UN SOMER World Ocean Assessment regular process to which reference should be made for further information (UNGA, 2016).

Fish stock propagation has **not** been specified as a SOMERSGA II indicator.

There is no evidence for significant investments in fish stock propagation in the Red Sea and Gulf of Aden region at this time. Restocking of pearl oyster in the Sudan has been proposed.

Recommendations

Given the lack of SOMERSGA II indicators for "*Fish Stock Propagation",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 14: Seaweeds

"*Seaweeds*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

Seaweeds have **not** been specified as a SOMERSGA II indicator.

There is some evidence that seaweed replaces live hard coral cover when live hard coral dies making recovery of coral reefs following damage slower and less likely

There is no evidence for significant investments in seaweed cultivation in the RSGA at this time.

Recommendations

Given the lack of SOMERSGA II indicators for "*Seaweeds",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 15: Social and Economic Aspects of Sea-Based Food and Fisheries

"*Social and economic aspects of sea-based food and fisheries"* is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

"*Fisher Association membership*" is the only SOMERSGA II indicator specified for "*Social and economic aspects of sea-based food and fisheries"*.

Traditionally, coastal communities, in the RSGA, depended on agriculture, animal husbandry and imported staples such as sugar and rice for their food security. However, there are coastal fisher communities that depend, to a significant extent, on sea-based food and fisheries for their livelihoods. Subsistence and traditional fishing are generally not licensed whilst fishing vessels, generally speaking, are licensed.

Recommendations

Given the single SOMERSGA II indicator for "Social and economic aspects of sea-based food and fisheries", and links to Chapter 55 "Overall value of the Oceans to Humans", it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

15.1 Fisher Association membership

"*Fisher association membership*" (number/organisation/year) is a SOMERSGA II indicator. This indicator was ranked 29th out of 31 for 41 indicators with an environmental weighting of 5.73 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

"*Fisher association membership*" gives an indication of the numbers of actively organised fishers and is a proxy for the governance of the fisheries and social, economic, and environmental, dependency. However, it should be noted that fisher association membership does not, necessarily, provide any information on the status of poorly represented, or unrepresented fishers.

Unfortunately, quantitative and objective information on "*Fisher association membership*" has not been sourced, for SOMERSGA II. Whilst some information is available it is not considered that it is very accurate.

Substantial investment will be needed to introduce a quantitative and objective system for determining, and reporting on, the status of "*Fisher association membership*" in the RSGA.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "*Fisher association membership",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

Chapter 16 : Synthesis of Part IV Food Security and Safety

"Synthesis of Part IV Food Security and Safety" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

"Synthesis of Part IV Food Security and Safety*"* comprises conclusions on the status of the indicators assessed in Part IV "*Assessment of the Cross-cutting Issues: Food Security and Food Safety" presented in* Chapters 10 through 15 of this SOMERSGA II report as described above.

Increased coastal urbanisation, tourism, and export, demand for sea-based food is increasing pressure on marine based fisheries (Fig 10).

Figure 10. Local fishers, Red Sea in Egypt (Credit: HEPCA)

Information on the status of marine capture fisheries in the Red Sea and Gulf of Aden is limited due to capacity constraints in fisheries monitoring, control and surveillance. It is indicated by some reports, based on various general production assumptions, that wild-caught fish stocks are underexploited. Such an indication should be viewed with caution and should not be assumed for all target stocks, particularly those, like grouper, that migrate to spawn (Dawson Shepherd, A., 2015).

Fisheries governance is also weak undermining effective management. No fisheries in the Red Sea and Gulf of Aden are internationally certified as sustainably sourced(9). Precautionary catch quotas are generally not set. Fisheries biodiversity refugia are either not provided or, if provided, are not managed to secure fisheries, particularly for species such as grouper that migrate to spawn. The risks to, and status of, fish stocks from climate change and contamination by pollutants could be significant and are not well assessed.

(9) See Chapter 11.2.

Aquaculture provides an opportunity, particularly in managing the risks from climate change, when closed systems are used. However, there are risks including: (1) Climate resilience and adaptation; (2) obtaining brood stock; (3) managing disease; (4) controlling pollution; (5) providing feed; (6) economic viability in competition with suppliers outside the region.

PART V ASSESSMENT OF OTHER HUMAN ACTIVITIES AND THE MARINEENVIRONMENT

Chapter 17 : Shipping

Shipping is a chapter title under the UN SOMER World Ocean Assessment regular process to which reference should be made for further information (UNGA, 2016).

The Red Sea and Gulf of Aden is a major global shipping route. Both the Red Sea and the Gulf of Aden are designated special areas under the International Convention for the Prevention of Pollution from Ships (MARPOL) in respect of Oil. The Red sea is designated as a special area in respect of garbage[10].

Figure 11: Container ship and facilities in Aqaba, Jordan

The Red Sea and Gulf of Aden are **not** designated as Particularly Sensitive Sea Areas (PSSAs) under MARPOL[11].

Five SOMERSGA II indicators related to shipping were proposed at the SOMERSGA II workshop in Jeddah in October 2018. Two "*Shipping tonnage*", and "*Oil spills*" are addressed in this Chapter. Three that are more directly related to Ports, namely: "EMS accredited *Ports* ", "*Waste oil reception facilities*", and "*Ballast water reception facilities*" are covered in Chapter 18.

Other possible "*Shipping*" indicators include: "*Shipping sunk*", "*Ship groundings*", "*Illegal ballast discharge", "*CO2 emissions per cargo tonne carried per km" etc.

Recommendations

Given the limited objective information obtained on the SOMERSGA II "Shipping" indicators described below and the possibility that other "Shipping" indicators should be considered it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

17.1 Shipping tonnage

Background

Shipping tonnage passing through the Red Sea is a SOMERSGA II indicator. This indicator was ranked 20th out of 31 for 41 indicators with an environmental weighting of 6.79 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

The Red Sea and Gulf of Aden is a major global shipping route. Shipping burns fossil fuels producing air pollution and greenhouse gasses. Shipping also poses a number of risks to the environment of the RSGA. These risks range from the catastrophic (ship groundings, collisions and sinking), to the chronic (wastewater/ballast water, marine litter, noise and physical disturbance).

(10) PERSGA held a regional training workshop on MARPOL Special Area Status at EMARSGA in Hurghada, Egypt in October 2009 (www.persga.org).
(11) www.imo.org

All signatories to the Jeddah Convention had, by 1998, ratified the 1982 Jeddah Convention Protocol concerning regional cooperation in combating pollution by oil and other substances in case of emergency (PERSGA, 1982b).

A number of multilateral environmental agreements (MEA) related to the minimisation of the adverse environmental effects of shipping have been signed by various Jeddah Convention signatories. The status of MEAs comprises a SOMERSGA II indicator (see Chapter 32.1).

Both the Red Sea and Gulf of Aden are designated special areas under MARPOL in respect of Oil. The Red sea is designated as a special area in respect of garbage. The Red Sea and Gulf of Aden is not designated as an International Maritime Organisation (IMO) Particularly Sensitive Sea Areas (PSSAs) under MARPOL[12].

Methodology

The only readily accessible source of information on shipping in the Red Sea and Gulf of Aden is available from the Suez Canal Authority[13].

The analysis of this source of information comprises a comparison of the annual tonnage passing through the Suez Canal recorded between 2000 and 2005 compared with the annual tonnage recorded between 2006 and 2017.

Unfortunately, there is no record of shipping that enters and exits the Red Sea via the Bab el Mandeb or that moves purely within the RSGA region.

Status

The results of the analysis are shown in Figure 12 below. Shipping tonnage, based on available figures, has increased by an annual average of 372,225,000 tonnes per year ± 4,526,000 tonnes (approximately 70%). The SOMERSGA II status for this indicator is headlined as deteriorating for the reasons given above. However, an increase in shipping may not, necessarily, result in environmental deterioration if there are effective environmental management measures such as

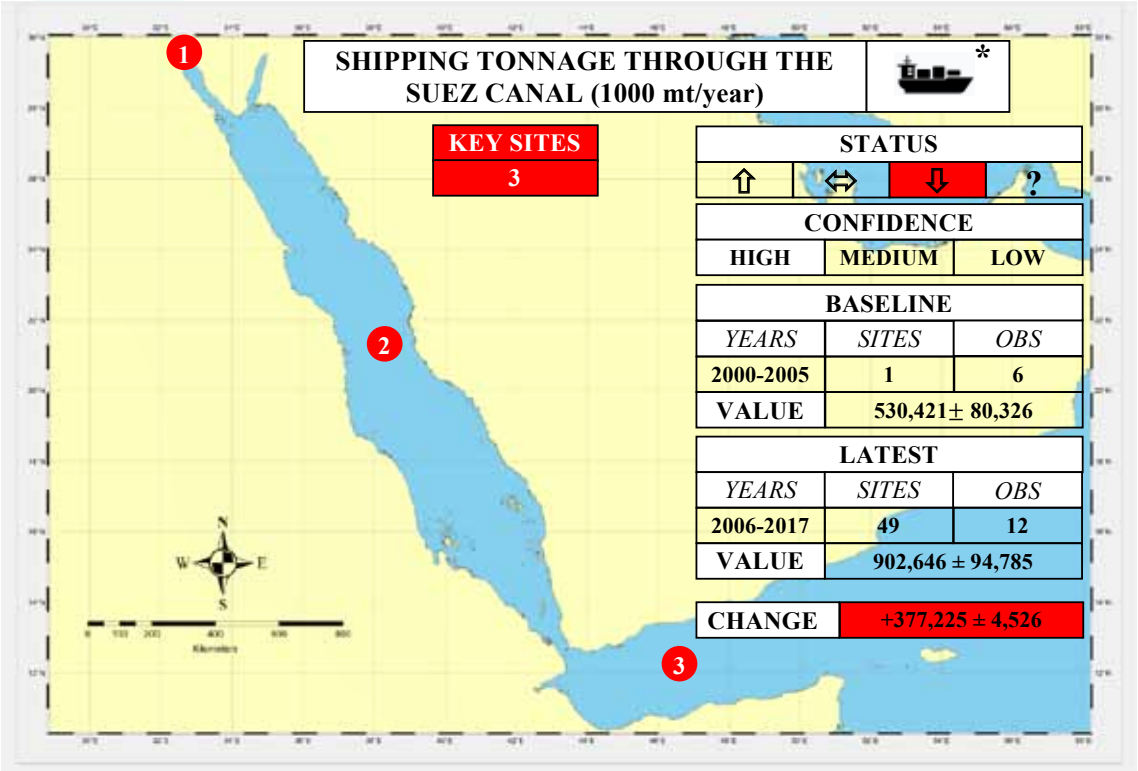


*Figure 12: Status of SOMERSGA indicator – Shipping (1000's tonnes) passing through PERSGA region. (*Icon made by Freepik from www.flaticon.com)*

(12) www.imo.org
(13) https://www.suezcanal.gov.eg/English/Navigation/Pages/NavigationStatistics.aspx)

improvements in CO2 emissions per cargo tonne carried per km. Information on such measures may result in a change in the environmental impact headline. It follows that any proponent of a change in the headline should provide the necessary information.

A number of shipping linked SOMERSGA II indicators, in addition to shipping tonnage, are proposed including: (a) environmental impact indicators such as marine litter, oil spills, solid waste production, and; (b) environmental impact management indicators including wastewater treatment, ports with ballast water reception facilities, ports with waste oil reception facilities, solid waste coastal clean-up events, and ports by annual tonnage with/without internationally accredited environmental management systems (EMS). It has generally not been possible to quantify these indicators in the SOMERSGA II process. Hopefully, this will be possible for SOMERSGA III.

Key Sites

Key site 1 indicates the location where the tonnage of shipping passing through the Red Sea is assessed.

Key site 2 identifies the need to identify the tonnage of shipping that is loaded, transferred, and discharged, solely within the RSGA.

Key site 3 identifies the need to identify the tonnage of shipping that enters or exits the RSGA from the Indian Ocean and loads/discharges in RSGA ports.

Recommendations

It is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify indicators and their means of objective and quantitative verification that can be used to elucidate the environmental impact of shipping passing through the region.

In addition, it is recommended that efforts should be made to determine:

1. the tonnage of shipping that: (1) Enters and exits the RSGA from the Indian Ocean and loads/discharges in RSGA ports; (2) Loads and discharges solely within the RSGA region.
2. CO2 emissions per cargo tonne carried per km.
3. other SOMERSGA II environmental impact and environmental impact management indicators related to shipping.
4. Consideration should be given to seeking recognition of the RSGA region as an International Maritime Organisation (IMO) Particularly Sensitive Sea Area (PSSA) under MARPOL.
5. PERSGA should deliver a SOMERSGA III report to include an assessment of delivery of recommendations 1 through 4 by the end of 2025.

17.2 Oil spills

"*Oil spills*" (all sources tonnage per year) is a SOMERSGA II indicator. This indicator was ranked 6th out of 31 for 41 indicators with an environmental weighting of 8 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Oil pollution is primarily addressed in the RSGA through the Jeddah Convention "Protocol Concerning Regional Co-operation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency (1982)". All 7 signatories to the Jeddah Convention had ratified the protocol by 1998.

Oil pollution is also addressed by the "*Protocol Concerning the Protection of the Marine Environment from Land Based Activities*" (LBA Protocol), (PERSGA, 2005a), where the source of the oil is from the land. The LBA Protocol was adopted in Jeddah on 25th September 2005 and by the 13th July 2017 had been ratified by 4 of the 7 national signatories to the Jeddah Convention.

The International Convention for the Prevention of Pollution from Ships, MARPOL 73/78 Annex I, provides regulations for the prevention of discharge, by ships, of oil, and oily materials, into the sea.

The status of ratifications of Annex I MARPOL 73/78 as of April 2019 is: Djibouti (yes), Egypt (yes), Jordan (yes), Saudi Arabia (yes), Somalia (no), Sudan (yes), Yemen (no)[14].

Globally significant incidents of oil pollution have fallen dramatically in the last 30 years. Whilst oil spills have catastrophic impact locally there is limited evidence of their long-term impact. None of the 20 largest oil spills recorded globally has occurred in the RSGA region[15]. Unfortunately, there is no comprehensive register of oil spills in the RSGA although figures provided by EMARSGA show 13 oil spills, all but one, in Egyptian Red Sea waters between 2013 and 2017 (total 1178 tonnes). Most were small. The largest at 1000 tonnes was in 2013 in Yemen. A large oil spill from an **oil rig** was reported for Jebel al-Zayt in the northern Red Sea Egyptian waters in 2010. The only major vessel related oil spill reported for the Red Sea and Gulf of Aden in the last 30 years was in the Gulf of Aden in 2002 at 12,200 tonnes[16]. A major oil spill occurred from a pipeline in the Red Sea Governorate of Egypt in the early 1980's.

All signatories to the Jeddah Convention, **except** for Somalia, have had oil spill contingency plans prepared[17].

Status

There is insufficient information with which to determine the status of oil spills under SOMERSGAII.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "*Oil spills",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

Chapter 18 : Ports

"*Ports*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

Three SOMERSGA II indicators related to Ports, namely: "EMS accredited *Ports*", "*Waste oil reception facilities*", and "*Ballast water reception facilities*" are covered in this Chapter.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II "Ports" indicators described below, and the possibility that other "Ports" indicators should be considered, it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

18.1 EMS accredited Ports

"EMS (Environmental Management System) accredited *Ports*[18]" (by annual tonnage) is a SOMERSGA II indicator. This indicator was ranked 27th out of 31 for 41 indicators with an environmental weighting of 6 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

(14) http://www.imo.org/en/About/Conventions/StatusOfConventions/Documents/status-x.xlsx
(15) https://www.itopf.org/knowledge-resources/data-statistics/statistics/
(16) https://en.wikipedia.org/wiki/List_of_oil_spills
(17) http://www.persga.org
(18) Such as ISO 14001 and Ecoports Port Environmental Review System (PERS)

Recognition of, and compliance with, internationally accredited Port EMS strengthens an environmentally responsible work ethic and reduces the risks of both: (a) **chronic** pollution, such as that from greenhouse gasses, solid and liquid waste emissions; and (b) **catastrophic** pollution such as that from major accidents.

Unfortunately, quantitative and objective information on Port EMS for SOMERSGA II is limited. Whilst some information is available[19] it is not comprehensive.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "EMS accredited Ports*",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

18.2 Waste oil reception facilities

Ports with "Waste oil reception facilities" by capacity is a SOMERSGA II indicator. This indicator was ranked 16th out of 31 for 41 indicators with an environmental weighting of 7 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

The Protocol Concerning Regional Cooperation in Combating Pollution by Oil and Other Harmful Substance in Cases of Emergency under the Jeddah Convention was adopted in Jeddah on 14th February 1982 (PERSGA, 1982b). All signatories to the Jeddah Convention have ratified this protocol. Whilst the Protocol does not specifically mention waste oil reception facilities the provision of such facilities is implicit in dealing with pollution by oil generally and in cases of emergency specifically.

Whilst there are few oil spills reported for the RSGA region (see the "Oil spills" indicator information in sub-chapter 17.2 above) it is likely that there are a large number of small unreported oil spills, and also disposals of waste oil from vessel engines and other sources. All these sources can have negative local environmental impacts if disposed of incorrectly. Effective waste oil management requires the collection of the oil, its storage pending treatment/disposal, and its appropriate disposal. Waste oil reception facilities provide storage and initial treatment capacity minimising the need to dispose of oil, in the sea and/or on land, without treatment.

It has not been possible to obtain quantitative and objective information on waste oil reception facilities for SOMERSGA II. A key source of information is the International Tanker Owners Pollution Federation (ITOPF) which provides a summary of oil spill response arrangements and resources in maritime nations. Information is provided for all Jeddah Convention signatories except Somalia[20]. Unfortunately, the information provided by ITOPF does not, generally, include objective details of waste oil reception facilities.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "*Waste oil reception facilities"* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

18.3 Ballast water reception facilities

Ports with *"Ballast water reception facilities"* by capacity is a SOMERSGA II indicator. This indicator was ranked 12th out of 31 for 41 indicators with an environmental weighting of 7.33 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

(19) https://www.ecoports.com/network indicates that Aqaba Container terminal, in Jordan, is both PERS and ISO14001 certified but the status of other Ports, in respect of EMS certification, in the RSGA is not known.
(20) https://www.itopf.org/knowledge-resources/countries-territories-regions/

Three of seven signatories to the Jeddah Convention have ratified the "*International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004*" (IMO, 2004). The Convention, adopted under the UN International Maritime Organisation, came into force in 2017.

Whilst the Convention does not specifically mention "Ballast Water Reception Facilities"," *Sediment Reception Facilities"* are indicated. The provision of ballast water and ballast sediment reception facilities should help deal with pollution from ballast water discharge generally and the introduction of invasive aquatic species carried in ballast water specifically.

Unfortunately, quantitative and objective information on ballast water and sediment reception facilities for SOMERSGA II was not available at the time this SOMERSGA II was prepared.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "Ballast Water Reception Facilities", and the proposed SOMERSGA III indicator "Sediment Reception Facilities" it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify this information.

Chapter 19: Submarine Cables and Pipelines

"*Submarine cables and pipelines*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

Information on submarine **cables** is provided on a website(21). The RSGA is a major global route for submarine cables connecting Asia with Europe.

Information on submarine **pipelines** is provided in the Admiralty Sailing Directions NP64 Red Sea and Gulf of Aden Pilot, 19th Edition, 2018. The RSGA is, generally speaking, not a major route for submarine pipelines although there are pipelines associated with oil and gas fields and oil and gas shipping facilities.

Neither submarine cables nor submarine pipelines were specified as a SOMERSGA II indicator and the status of these indicators is not assessed in this SOMERSGA II Report. However, it is recommended, in compliance with the regular process, that they are given due consideration for SOMERSGA III.

Recommendations

Given the Chapter title and the lack information from SOMERSGA II on "*Submarine cables and pipelines*", it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

Chapter 20: Coastal, Riverine and Atmospheric Inputs from Land

"*Coastal, riverine and atmospheric inputs from land*" is a chapter title under the UN SOMER World Ocean Assessment (WOA) regular process to which reference should be made for further information (UNGA, 2016).

The Jeddah Convention includes the "*Protocol Concerning the Protection of the Marine Environment from Land Based Activities*" (LBA Protocol, PERSGA, 2005a). The LBA Protocol was

(21) https://www.submarinecablemap.com/

adopted in Jeddah on 25th September 2005 and by the 13th July 2017 had been ratified by 4 of the 7 national signatories to the Jeddah Convention.

Annexes I and III, of the LBA Protocol, do not list, but refer to, properties and categories[22] of solid, liquid and air-borne substances in the environment, specified in Annex 1[23] of the Global Programme of Action (GPA) for the protection of the marine environment from land-based sources (UNEP, 1995). The list comprises: *(i) Sewage; ii) Persistent organic pollutants; (iii) Radioactive substances; (iv) Heavy metals; (v) Oils (hydrocarbons); (vi) Nutrients; (vii) Sediment mobilization; and (viii) Litter[24]".*

The GPA makes only one specific reference to air pollution. This reference is under the heavy metal contaminant/source category.

The categories in the GPA vary in the degree of quantification of targets. The draft GPA implementation review for the period 2012 to 2018 (UNEP, 2018) provides little reference to further quantification of targets.

GPA categories (UNEP, 1995) relating to chapters (chapters with limited relevance are in brackets) in the UN SOMER World Ocean Assessment (WOA) regular process (UNGA, 2016), and to SOMERSGA II indicators are tabled below.

GPA (1995) contaminants/ source categories*	UNGA (2016) chapters	SOMERSGA II	
		Indicator	Chapters
Sewage	,43 ,27 ,24 ,20 ,18 ,17 44	Wastewater treatment	20
		Zero wastewater discharge	20
Persistent organic pollutants (POPs)	20	POPs measurement in marine fish	20
Radioactive substances**	36 ,24 ,23 ,20 ,17	-	-
Heavy metals	,44 ,43 ,40) ,26 ,21 ,20 (47	-	-
(Oils) hydrocarbons	23 ,21 ,20 ,18 ,17	Oil spills	17
		Waste oil reception facilities	18
Nutrients	,24 ,20 ,17 ,(14) ,12 ,6 (47) ,44 ,(43 ,38) ,27 ,26	Chlorophyll A	20
Sediment mobilization	,27 ,26 ,25 ,24 ,23 ,7 ,6 (49) ,48 ,47 ,44 ,43 ,39	-	-
Litter (marine debris/litter)	27 ,25 ,24	Solid waste production	24
		Managed landfill sites	24
		Marine litter (debris)	25
		Solid waste coastal clean-up events	25
Multiple categories	-	Population of the coastal zone	8
		Shipping tonnage	17
		EMS accredited ports	18
		Ballast water reception facilities	18
		Blue Flag compliant beaches	32
Other	20	Marine Waters pH	20
	28	Desalination capacity	28

* LBA Protocol (PERSGA, 2005a) refers to properties and categories
**Article 4.I(a) of the Jeddah Convention LBA Protocol (PERSGA, 2005a) specifies that the scope of the Protocol includes radioactive substances.

(22) The GPA document (GPA, 1995) refers to contaminants/source categories.
(23) The contaminants/source categories are not listed in an Annex of GPA, 1995 but in paragraph 21(b).
(24) It should be noted that the term "Litter" in the GPA (GPA, 1995) should be viewed as synonymous with the terms "*Marine Litter*" used in the Jeddah Convention LBAs Protocol (PERSGA, 2005a) and "*Marine Debris*" used in the UN SOMER World Ocean Assessment (WOA) regular process (UNGA, 2016).

Recommendations

Given the lack of SOMERSGA II indicators for radioactive substances, heavy metals and sediment mobilization in support of the LBA Protocol (PERSGA, 2005) and the limited guidance on the quantification of targets (UNEP, 2018) it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to address these deficiencies.

20.1 Freshwater related inputs

The RSGA contains **no** continuously (perennial) surface freshwater flows to the sea. Locations where there are seasonal surface freshwater flows are rare. The Barka river flows seasonally into the Tokar delta and from there into the Red Sea in southern Sudan. Flash floods are occasional and can be significant. Subsoil freshwater flows to the sea are significant in certain areas and support coastal freshwater dependent vegetation and, in a limited number of small areas, coastal brackish water lagoons.

Four SOMERSGA II indicators have been specified in respect of freshwater related inputs into the coastal and marine environment primarily from Land Based Activities (LBAs). These include: (1) Wastewater treatment; (2) Zero wastewater discharge; (3) Persistent Organic Pollutants (POPS); (4) Chlorophyll. These four proposed SOMERSGA II indicators are described below.

Other freshwater inputs, including flash floods, were **not** specified as SOMERSGA II indicators and the status of these indicators is **not** assessed in this SOMERSGA II Report.

Recommendations

Given the limited information obtained on the four SOMERSGA II *"Freshwater related inputs*" indicators described below, and the possibility that there may be other relevant indicators of *"Freshwater related inputs*, it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

20.1.1 Wastewater treatment

"Wastewater (sewage) treatment" capacity is a SOMERSGA II indicator. This indicator was ranked 8th out of 31 for 41 indicators with an environmental weighting of 7.67 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

The Jeddah Convention LBA Protocol Article 6 (PERSGA, 2005a) relates to the treatment and management of "used water". "Sewage and Nutrients" are also specified in the GPA (UNEP, 1995) referred to in the LBA Protocol. There is also strong policy direction for improved wastewater treatment provided in the 2030 Agenda for Sustainable Development, adopted in 2015 (UNGA, 2015), which updates the Millennium Development Goals (MDGs).

In addition, the International Convention for the Prevention of Pollution from Ships, MARPOL 73/78 Annex IV provides regulations for the Prevention of Pollution by Sewage from Ships.

Status of ratifications of Annex IV as of April 2019 is: Djibouti (yes), Egypt (yes), Jordan (yes), Saudi Arabia (yes), Somalia (no), Sudan (yes), Yemen (no)[25].

The significant increase in human population in the coastal zone in the last 30 years (sub-chapter 8.1 above) has resulted in higher wastewater production. Whilst an environmental benefit of unmanaged wastewater discharge on land may be to attract waterfowl, environmental costs include a source of certain diseases, smells and groundwater contamination.

Historically, and in areas where there is no centralised wastewater treatment, wastewater is discharged directly onto the ground which, in much of the coastal area in the RSGA, is geologically composed of fossil coral reef and associated calcareous material that is highly porous. From there it slowly seeps into the sea.

(25) http://www.imo.org/en/About/Conventions/StatusOfConventions/Documents/status-x.xlsx

Environmental risks from wastewater discharge to the sea may include increased nutrient and sediment levels, reduced water clarity and oxygen levels as organic material in the wastewater decomposes, and disease carried from the land. Coral reefs in the RSGA have evolved in clear, oxygen saturated, nutrient poor waters and so are particularly vulnerable to wastewater stressors. Wastewater may also act cumulatively with other stressors such as elevated seawater temperatures from climate change and physical disturbance from coastal construction and recreational use.

Unfortunately, quantitative and objective information on wastewater treatment in the RSGA is limited. PERSGA held a workshop on wastewater treatment in 2014 (PERSGA, 2014a), which recommended the need to address lack of information and data in this regard. FAO Aquastat[26] provides very little data for the region including recent data. The box below provides a summary of information that is available for SOMERSGA II.

SOMERSGA II INDICATOR: WASTEWATER TREATMENT

Djibouti 2017: It is indicated that *"Until the beginning of March 2014, wastewater collected was discharged without treatment, mainly at sea"*[27]. It is reported that one treatment plant exists in Douda and one is planned for Balboa. The capacities are not known. In 2017 it is indicated that 2000m^3/day of treated wastewater will be available for irrigation[28].

Egypt 2019: It has not been possible to source any wastewater treatment information for urban centres such as Hurghada, Safaga, Quseir and Sharm-el-Sheikh in the Egyptian Red Sea. It is understood that certain tourist facilities have wastewater treatment.

Jordan 2015: Wastewater treatment capacity in Aqaba, Jordan, is indicated to have been 9000m^3/day in 1986. Capacity was increased to 12,000m^3/day in 2005[29] with plans, in 2015, to increase capacity to 16,000m^3/day[30].

Saudi Arabia 2018: Tertiary treatment of wastewater was indicated to be a legal requirement in Saudi Arabia in 2000[31]. In 1998 the Al Khumrah wastewater treatment plant in **Jeddah** had a capacity of 60,000m^3/day. This rose to 140,000m^3/day in 2004 and to 250,000m^3/day in 2013[32]. A wastewater treatment project with a capacity of 500,000m^3/day was announced in 2019 and is due to come on-line in 2021[33]. The **Jizan** region was reported to have a tertiary treatment capacity of 835,200m^3 in 2016[34]. Information on wastewater treatment facilities in other coastal towns and cities in the Red Sea coastal area of Saudi Arabia has not been sourced.

Somalia 2019: It has not been possible to source any information on wastewater treatment facilities in the coastal area of Somalia including the area covered by the Jeddah Convention.

Sudan 2019: It is understood that there are no wastewater treatment facilities in the coastal area of Sudan including **Port Sudan**.

Yemen 2015: Wastewater treatment facilities were provided in **Hodeidah** under the Hodeidah Water Supply Project World Bank loan (P005761) commencing in 1975. In 2015 the wastewater treatment capacity in Hodeidah was indicated to be 53,000m^3/day. It is suggested that the capacity has declined since then due to the current special situation in the Country[35]. In 2015 the wastewater treatment capacity in **Aden** was indicated to be 95,000m^3/day. It is also suggested that the capacity has declined since then due to the current special situation in the Country[36].

(26) http://www.fao.org/nr/water/aquastat/wastewater/ has limited data and recent data.
(27) https://www.afd.fr/fr/un-systeme-dassainissement-performant-djibouti
(28)https://afwa-hq.org/index.php/en/news/item/341-world-water-day-in-djibouti-onead-advocates-the-reuse-of-treated-wastewater-in-agriculture
(29) https://aw.jo
(30) https://pdf.usaid.gov/pdf_docs/PA00KJGZ.pdf
(31) https://journal.gnest.org/sites/default/files/Submissions/gnest_01887/gnest_01887_published.pdf
(32)https://www.gkw-consult.com/en/projects/wastewater/single/article/kingdom-of-saudi-arabia-wastewater-treatment-plant-al-khumrah/
(33) http://saudigazette.com.sa/article/559958/SAUDI-ARABIA/Jeddah-to-get-new-sewage-treatment-plant
(34) https://journal.gnest.org/sites/default/files/Submissions/gnest_01887/gnest_01887_published.pdf
(35) http://documents.worldbank.org/curated/en/494961526464057594/pdf/P164190-ESMF-Final.pdf
(36) http://documents.worldbank.org/curated/en/494961526464057594/pdf/P164190-ESMF-Final.pdf

Recommendations

Given the limited information, for SOMERSGA II, on SOMERSGA II indicator "*Wastewater treatment",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

20.1.2 Zero wastewater discharge

"Zero wastewater discharge" is a SOMERSGA II indicator. A policy of zero wastewater discharge to the marine environment was ranked 5th out of 31 for 41 indicators with an environmental weighting of 8.13 out of 10 at the Jeddah SOMERSGA II workshop in October 2018. The indicator primarily relates to sewage (black water/foul water) discharges from sewage outfalls or sewage bowsers. However, industrial wastewater such as that from desalination, refineries, industrial areas, and power plants should also be considered.

The indicator does not cover non-point groundwater seepages from septic tanks and other non-point sources which are significant but can only be managed when there are surface irrigation controls, and there is a fully connected wastewater collection, treatment and use system.

Unfortunately, it has not been possible to contain information on the location, type, and rate of discharge, into the marine environment from point sources for SOMERSGA II. Hopefully the information can be obtained for SOMERSGA III with which to assess delivery of any zero-wastewater discharge policy. The following box provides a summary of information that is available for SOMERSGA II on zero wastewater discharge policy for Jeddah Convention countries in the region.

SOMERSGA II INDICATOR: ZERO WASTEWATER DISCHARGE

Djibouti 2019: It has not been possible to source any policy direction concerning zero wastewater discharge to the marine environment in Djibouti.

Egypt 2019: It is understood that there is a policy of zero wastewater discharge to the Egyptian Red Sea. This understanding, and the types of discharge that the policy relates to, need to be verified.

Jordan 2019: It is understood that there is a policy of zero "sewage" wastewater discharge to the Jordanian Red Sea(37). This understanding, and the types of discharge that the policy relates to, need to be verified.

Saudi Arabia 2019: Tertiary treatment of wastewater was indicated to be a legal requirement in Saudi Arabia in 2000(38). Whether there is a zero "sewage" wastewater discharge policy for the Saudi Red Sea needs to be determined.

Somalia 2019: It has not been possible to source any policy direction concerning zero wastewater discharge to the marine environment in Somalia.

Sudan 2019: It has not been possible to source any policy direction concerning zero wastewater discharge to the marine environment in Sudan.

Yemen 2019: It has not been possible to source any policy direction concerning zero wastewater discharge to the marine environment in Yemen.

Recommendations

Given the limited information, for SOMERSGA II, on SOMERSGA II indicator "*Zero wastewater discharge",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

(37) http://www.persga.org/inner.php?id=317
(38) https://journal.gnest.org/sites/default/files/Submissions/gnest_01887/gnest_01887_published.pdf

20.1.3 Laboratory capacity to analyse POPs in marine fish

Laboratory capacity to analyse the levels of Persistent Organic Pollutants (POPs) in marine fish(39) is a SOMERSGA II indicator. This indicator was ranked 19th out of 31 for 41 indicators with an environmental weighting of 6.8 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

POPs are an environmental concern in the RSGA principally through their bioaccumulation through the food chain and their adverse impact on human, and other, animal health(40). In respect of legal obligations and POPs:

1. By 2012 all 7 signatories to the Jeddah Convention had ratified the Stockholm Convention on Persistent Organic Pollutants which came into force in 2004(41).

   As of April 2019, only Yemen, of the 7 parties to the Jeddah Convention/Stockholm Convention from the RSGA region, had submitted a fourth round of party reports due 31st August 2018.

2. By 2017, 4 of the 7 signatories to the Jeddah Convention had ratified the Jeddah Convention "Protocol Concerning the Protection of the Marine Environment from Land Based Activities" (LBA Protocol), (PERSGA, 2005a)(42).

   A RSGA regional project entitled "Promotion of strategies to reduce unintentional production of POPs in the Red Sea and Gulf of Aden (PERSGA) coastal zone" (GF/RAB/08/006) commenced in 2009 and finished in 2011. The national project partners included Egypt, Jordan, Saudi Arabia, Sudan, and Yemen.

   The mid-term/final evaluation report for the Project (Fejes, S., 2011) indicates that "Laboratory capacity in the region has also been strengthened(43). The report also indicates that "Ben Hayyan Laboratory still needs an on-the-job training in their facilities before they are fully capable of analysing UP-POPs".

However it has not been possible to source any information on laboratory capacity to analyse POPs in the RSGA region for SOMERSGA II.

Hopefully it will be possible to identify national capacity to analyse POPs in RSGA parties to the Stockholm Convention for SOMERSGA III.

Recommendations

Given the limited information, for SOMERSGA II, on SOMERSGA II indicator "*Laboratory capacity to analyse POPs in marine fish",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

20.1.4 Chlorophyll A

Chlorophyll A is a SOMERSGA II indicator. This indicator was ranked 4th out of 31 for 41 indicators with an environmental weighting of 8.2 out of 10 at the Jeddah SOMERSGA II workshop in October 2018. It is included under freshwater related inputs because it is a proxy indicator of nutrient input from land. However, it also has relevance to Chapter 6 "*Primary Production, Cycling of Nutrients, Surface Layer and Plankton*".

Chlorophyll A is an indicator of phytoplankton (plant) productivity. Higher phytoplankton productivity may reflect natural processes where nutrient rich deeper waters mix with surface waters where there is enough light for photosynthesis. High phytoplankton productivity may also result locally where there are nutrient inputs from land, for example, from sewage wastewater, or even dust.

(39) A marine fish can be defined as any living organism that critically depends on the marine environment for any stage of its life.
(40) http://www.persga.org
(41) http://chm.pops.int/
(42) POPS are not specifically mentioned in the Protocol although they are incidentally referred to in Article 5. POPs are specified in the GPA (UNEP, 1995) referred to in the LBA Protocol.
(43) Providing capacity to undertake laboratory analysis of POPs was not part of the Project design.

Chlorophyll A is a proxy indicator for phytoplankton productivity through photosynthesis. It is also a proxy for the removal of carbon dioxide directly from the sea and indirectly from the atmosphere through a process known as **carbon sequestration**. The process of photosynthesis also produces oxygen. However, photosynthesis only operates when there is light. During the dark the process reverses with oxygen uptake and carbon dioxide production. This can cause local oxygen depletion where there are high levels of phytoplankton. Where there is oxygen depletion it can put stress on marine life that depends on oxygen.

Unfortunately, it has not been possible to obtain information on chlorophyll A values in the RSGA with all the key required attributes although there has been monitoring of this indicator in Egypt (Fahmy et., al., 2016), Djibouti[44], Jordan (MSS, 2003-2016), and Saudi Arabia[45].

Recommendations

Given the limited information, for SOMERSGA II, on SOMERSGA II indicator "*Chlorophyll A",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

20.2 Atmospheric inputs

Article 4.I(b) of the Jeddah Convention LBA Protocol (PERSGA, 2005a) specifies that the scope of the Protocol includes Air-borne pollutants. The GPA (UNEP, 1995) referred to in the LBA Protocol makes only one specific reference to air pollution. This reference is under the heavy metal contaminant/source category. A key air-born group of pollutants comprises greenhouse gasses which are a major driver of anthropogenic (human driven) climate change. Greenhouse gasses such as carbon dioxide are produced naturally but there is a significant additional contribution from the burning of fossil fuels on land although they can also be produced by the burning of fossil fuels at sea and in the air. Certain greenhouse gasses can also be produced by farming activities although this production is relatively limited in the RSGA region.

No proposed SOMERSGA II indicators relate directly to air pollution. However, a proxy indicator of the effect of greenhouse gasses is specified, namely the pH of seawater.

The Paris Agreement (UN, 2015) sets a target in respect of global temperature increase of 1.5 to 2.0 degrees centigrade above pre-industrial levels requiring reductions in anthropogenic greenhouse gas emissions to be delivered through the Nationally Determined Contributions (NDC) process. PERSGA hosted a Regional Workshop on "*Ecosystem Approach in Nationally Determined Contributions 'NDCs' for Climate Change Adaptation and Mitigation in Coastal Areas*", in October 2017[46], and in 2016 PERSGA hosted a regional workshop on "Adaptation Strategies for the Impacts of Ocean Acidification"[47].

Recommendations

Given the lack of direct atmospheric input indicators for SOMERSGA II, it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify relevant indicators of atmospheric inputs and their means of objective and quantitative verification. In addition, given the seriousness of climate change, it is recommended that this process is followed for NDC indicators.

20.2.1 pH (high accuracy)

"*pH (high accuracy)"* is a SOMERSGA II indicator. This indicator was ranked 7th out of 31 for 41 indicators with an environmental weighting of 7.87 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

(44) http://www.persga.org
(45) http://www.persga.org
(46) http://persga.org
(47) http://persga.org

Ocean acidification, resulting from anthropogenic climate change, is projected to become a significant environmental stressor in marine systems. pH has changed very little in an evolutionary time scale and so marine life has evolved little capacity to cope with any changes. Marine organisms that depend on the precipitation of calcium carbonate for their skeletons, such as reef building corals and certain molluscs, are particularly vulnerable. These organisms have to use more energy to precipitate calcium carbonate as the marine waters become more acid. This means that there is less energy available for other critical life functions including dealing with other stressors such as pollution and elevated sea temperatures.

Whilst pH is widely measured throughout the RSGA, as part of water quality monitoring studies, it is generally not measured at an accuracy that can detect ocean acidification. Indeed, there is reported to be only one location in the RSGA where such capacity exists[48]. PERSGA conducted a regional training workshop in Aqaba, Jordan, in October 2018 on how to measure Ocean Acidification and its impacts on the marine environment.

Unfortunately, it has not been possible to obtain information on pH in the RSGA at an accuracy that can detect the early stages of ocean acidification in time for SOMERSGA II.

Recommendations

Given the limited information, for SOMERSGA II, on SOMERSGA II indicator "*pH" (*high accuracy*),* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

Chapter 21: Offshore hydrocarbon industries

"*Offshore hydrocarbon industries*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

Offshore hydrocarbon industries include: (a) oil and gas platforms such as those found in the Gulf of Suez; (b) undersea oil and gas pipelines; (c) oil loading/offloading facilities (not a complete list) such as those found in Djibouti (Djibouti Oil Terminal), Egypt (Ain Sukhna and East Zeit), Saudi Arabia (Duba, Yanbu, Rabigh, Jeddah and Jizan), Somalia (Berbera), Sudan (Port Sudan, Bashayer), and Yemen (Ras Isa, Ash Shihr, and Belhaf); (d) Oil spill response facilities[49].

Recommendations

No "*Offshore hydrocarbon industries*" indicator has been specified for SOMERSGA II. It is, therefore, recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 22: Other Marine-Based Energy Industries

"*Other Marine-Based Energy Industries*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016). Other Marine-Based Energy Industries include renewable energy production industries such as tidal, wave, wind, solar and heat exchange.

There is no information with which to suggest that there are significant "Other Marine-Based

(48) http://portal.goa-on.org/Explorer
(49) https://www.itopf.org/knowledge-resources/countries-territories-regions/

Energy Industries" operating in, or proposed for, the RSGA. Given the heavy investment in renewable energy generating infrastructure globally it is likely that this will happen in the RSGA.

Recommendations

No "*Other Marine-Based Energy industries*" indicators have been specified for SOMERSGA II. It is, therefore, recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 23: Offshore Mining Industries

"*Offshore Mining Industries*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

Offshore mining industries are not specified as a SOMERSGA II indicator.

The Saudi-Sudanese Red Sea Commission initiative to look into the mining of deep-sea nodules/brines in the central Red Sea in the 1970's has not come to fruition. It is understood that there are, currently, no offshore mining industries, other than for oil and gas and coastal dredging for water deepening and fill material, operating in the RSGA.

Recommendations

Given that no SOMERSGA II indicators have been specified for "*Offshore Mining Industries"* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 24: Solid waste disposal

"*Solid waste disposal*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

The significant increase in human population and changing consumption and production patterns, in the coastal zone (see SOMERSGA II Indicator *"Population of the Coastal Zone"* in Chapter 8 above) has resulted in higher solid waste production, and the consequent need for improved waste disposal.

Article 7 of the Jeddah Convention "*Protocol Concerning the Protection of the Marine Environment from Land Based Activities*" (LBA Protocol), (PERSGA, 2005a) relates to the management of solid waste originating from land. The LBA Protocol was adopted in Jeddah on 25th September 2005 and by the 13th July 2017 had been ratified by 4 of the 7 national signatories to the Jeddah Convention.

Litter is specified in the GPA (UNEP, 1995) referred to in the LBA Protocol

The International Convention for the Prevention of Pollution from Ships MARPOL 73/78 Annex V provides regulations for the Prevention of Pollution by Garbage from Ships.

The status of MARPOL 73/78 Annex V ratifications, by Jeddah Convention signatories, as of April 2019, was: Djibouti (yes), Egypt (yes), Jordan (yes), Saudi Arabia (yes), Somalia (no), Sudan (yes), Yemen (no)[50].

(50) http://www.imo.org/en/About/Conventions/StatusOfConventions/Documents/status-x.xlsx

A number of SOMERSGA II indicators relate to the issue of solid waste. These include:

- Solid waste production (this chapter)
- Managed landfill sites by tonnage (this chapter)
- Solid waste coastal clean-up events (Chapter 25)
- Marine litter (Chapter 25)

A number of additional indicators could also be proposed as proxies for "*Solid waste disposal*" including managed landfill sites by category (for example sanitary landfill sites), incinerators, and reduce, re-use, recycle initiatives.

Recommendations

Given the limited information obtained on the two SOMERSGA II "Solid Waste disposal" indicators described below, and the possibility that there may be other relevant indicators of "Solid Waste disposal", it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

24.1 Solid waste production

"Solid waste production" is a SOMERSGA II indicator. This indicator was ranked 7th out of 31 for 41 indicators with an environmental weighting of 7.87 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

It has not been possible to source comprehensive and objective information on solid waste production in the RSGA in time for SOMERSGA II. Some limited information has been sourced. For example, it is reported that: Hurghada municipality, in Egypt, produces 450 tons of Municipal Solid Waste (MSW) a day(51); Aqaba municipality, in Jordan, produces 150 tons of waste a day(52); and Jeddah municipality, in Saudi Arabia, produces 5,000 tons of MSW a day(53).

Recommendations

Given the limited information for SOMERSGA II on SOMERSGA II indicator "*Solid waste production",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

24.2 Managed landfill sites

"*Managed landfill sites*" by tonnage is a SOMERSGA II indicator. This indicator was ranked 24th out of 31 for 41 indicators with an environmental weighting of 6.47 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

It has not been possible to source comprehensive, objective, quantitative, information on managed landfill sites in the RSGA in time for SOMERSGA II. Some information has been sourced. For example:

(51) http://www.hepca.org/conservation/solid-waste/hurghada/
(52) https://www.unenvironment.org/news-and-stories/story/turning-waste-asset-aqaba-jordan
(53) https://www.ecomena.org/waste-management-jeddah/

SOMERSGA II INDICATOR: MANAGED LANDFILL SITES

Djibouti: 2012 - A "new Technical Landfill (CET[54]) will have a total exploitable volume of 500,000 m3, for an exploitation period estimated between 5 and 6 years"[55].

Egypt: 2019 – No information on the location and capacity of managed landfill sites has been identified in the Egyptian Red Sea. It is understood that such sites do exist.

Jordan, Aqaba: 2010 - "*Aqaba has two landfills, one for construction waste and one for municipal waste, neither of which are sanitary. Unlike the Ghabawi landfill, Aqaba's municipal waste landfill has an official recycling contractor, who pays an annual fee for removing recyclables from inside the landfill. Unfortunately, no data on quantities of recyclables diverted is available*"[56].

Saudi Arabia, Jeddah: 2018 - "*Most of the MSW[57] is disposed in the landfill facility at Buraiman which receives approximately 1.5 million tons of waste per year and has an expected lifespan of between 30 and 40 years*".[58]

Somalia, Berbera: Undated - "*A full refuse management system was set up, including a new landfill that could be used for solid waste disposal in the years ahead*". No indication is given of the capacity[59].

Sudan, Port Sudan: Undated - No information on the location and capacity of managed landfill sites has been identified for the Sudanese Red Sea. It is suggested that waste management systems are not well developed[60].

Yemen: 2018 - (1) Aden – the landfill site is indicated to comprise a 4km^2 area with a capacity of 650 tons per day. The site is reported to have been operating for 15 years and that sorting facilities were destroyed during the war; (2) Hodeidah – the landfill site is indicated to comprise a 1km^2 area with a capacity of 350 tons per day. The site is reported to have been operating for 20 years and that the condition of the site is deteriorated[61].

Recommendations

Given the limited information for SOMERSGA II on SOMERSGA II indicator "*Managed landfill sites",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

Chapter 25: Marine Debris

"*Marine Debris*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

It should be noted that the term "*Marine Debris*" should be viewed as synonymous with the term "*Marine Litter*" used in the Jeddah Convention LBAs and garbage used in MARPOL 73/78 Annex V.

Much marine debris originates from land "addressed under the Jeddah Convention LBA Protocol (PERSGA, 2005a)" although a proportion originates from shipping (addressed under MARPOL 73/78 Annex V).

(54) Custom Environmental Technology (CET)
(55) https://www.skyscrapercity.com/showthread.php?t=1514339
(56) In 2010: http://haqqi.info/check_1.php?t=research_paper&f=HRIDJR0308_SolidWasteBehavior_En_2010
(57) Municipal Solid Waste (MSW)
(58) https://www.ecomena.org/waste-management-jeddah/
(59) http://mirror.unhabitat.org/content.asp?cid=9853&catid=233&typeid=13
(60) https://postconflict.unep.ch/publications/sudan/12_marine.pdf
(61) http://documents.worldbank.org/curated/en/494961526464057594/pdf/P164190-ESMF-Final.pdf

Originating from land: Article 7 of the Jeddah Convention "*Protocol Concerning the Protection of the Marine Environment from Land Based Activities*" (LBA Protocol) relates to the management of solid waste originating from land (PERSGA, 2005a).

Originating from shipping: The International Convention for the Prevention of Pollution from Ships MARPOL 73/78 Annex V provides regulations for the Prevention of Pollution by Garbage from Ships.

Two SOMERSGA II indicators, in addition to those indirect SOMERSGA II indicators presented in Chapter 24 relating to solid waste, relate to marine debris. The two indicators: (1) "*Marine Litter*" and; (2) "*Solid waste coastal clean-up events*" are described below in this Chapter.

Recommendations

Given the limited information obtained on the two SOMERSGA II "Marine debris" indicators described below, and the possibility that there may be other relevant indicators of "Marine debris", it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

25.1 Marine Litter (debris)

"*Marine litter*" (marine debris) is a SOMERSGA II indicator and can be viewed as synonymous under Annex V of MARPOL 73/78. This indicator was ranked 3rd out of 31 for 41 indicators with an environmental weighting of 8.8 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

It has not been possible to source comprehensive, objective, quantitative, information on the status of "*Marine litter (debris)*" in the RSGA, in the required format, in time for SOMERSGA II. However, in 2008, PERSGA produced an assessment of Marine litter in the PERSGA region (PERSGA/UNEP, 2008) and in 2014 PERSGA produced Coastal marine litter assessment guidelines for the Red Sea and Gulf of Aden (PERSGA, 2014b). Surveys using these guidelines have been undertaken in the period between 2008 and 2018 but the information still has to be provided to SOMERSGA II. A Regional Action Plan for the Sustainable Management of Marine Litter in the Red Sea and Gulf of Aden was produced in 2018 (PERSGA/UNE, 2018). Guidelines to prepare national action plans to manage marine litter in the PERSGA region was produced in 2019 (PERSGA 2020).

Recommendations

Given the limited information for SOMERSGA II on SOMERSGA II indicator "*Marine litter (debris)",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

25.2 Solid waste coastal clean-up events

"Solid waste coastal clean-up events" is a SOMERSGA II indicator. This indicator was ranked 15th out of 31 for 41 indicators with an environmental weighting of 7.07 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Coastal clean-up events demonstrate an understanding of the need to, and a commitment to reduce, marine litter. Major examples of this commitment to reduce marine litter, are the Hurghada Environmental Protection and Conservation Association (HEPCA) contracts to manage solid waste for Hurghada City and Marsa Alam in the Red Sea Governorate of Egypt(62).

(62) http://www.hepca.org/conservation/solid-waste/

Some recent examples of beach clean-ups in the PERSGA region are presented in the following box:

SOMERSGA II INDICATOR: SOLID WASTE COASTAL CLEAN-UP EVENTS
Djibouti, 2019: https://www.dvidshub.net/image/5289478/earth-day-beach-clean-up-djibouti, http://www.so-global.com/news/beach-environmental-clean-day-djibouti/
Egypt Hurghada Magawish 2018: https://ww.egyptindependent.com/cleaning-campaign-commences-in-red-sea-island-magawish-in-hurghada/
Jordan, Aqaba 2019: http://www.jreds.org/en-us/Achievements-Management/ArticleID/6/clean-up-the-world
Saudi Arabia, Jeddah 2019: http://saudigazette.com.sa/article/562492/SAUDI-ARABIA/Over-2000-volunteers-team-up-to-clean-Jeddah-shores
Somalia 2019: No information available.
Sudan 2019: No information available.
Yemen 2019: No information available.

Recommendations

Given the limited information for SOMERSGA II on SOMERSGA II indicator "*Solid waste coastal clean-up events",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

Chapter 26: Land/Sea Physical Interaction

"*Land/Sea Physical Interaction*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

No tsunamis are reported from the RSGA region. Earthquakes are reported from the RSGA region. Storm surges are reported from the Gulf of Aden. Occasional but significant local flash floods occur throughout the RSGA. Locally, significant sedimentation or erosion events occur throughout the RSGA and these are likely to increase as sea-level rises.

No SOMERSGA II indicators have been proposed for "*Land/sea physical interaction*". Possible indicators to be considered for SOMERSGA III include the location, size and frequency of: (1) Flash floods; (2) storm surges; (3) shoreline change, and; (4) sea-level change.

Recommendations

Given the lack of SOMERSGA II indicators for "Land/Sea Physical Interaction", and taking note of the suggestions above, it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

"Tourism and Recreation" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

Both marine tourism and recreation are significant development areas in PERSGA member states. Well established investments exist in Egypt (Fig 13) and Jordan, while significant ongoing investments are being established in Saudi Arabia. Potential for tourism in Somalia, Sudan, and Yemen are high, however, the lack of infrastructure and significant investments in these three RSGA countries are constraints.

Unfortunately, unmanaged "Tourism and Recreation" have potentially adverse effects on the environment. These adverse effects may include: (1) overexploitation of freshwater resources; (2) increased solid and liquid waste production; (3) increased greenhouse gas production; (4) loss of natural habitat to new infrastructure; (5) disturbance of natural habitat (diver damage to reefs) and species (disturbance of nesting birds and turtles) from over-use etc.

Figure 13. Tourist Boats Ras Bob - Sharm El Shiekh, Egypt, 2018. Credit: Mohammed Ismail

Conversely tourism and recreation increasingly depend on a healthy environment. This dependency provides an incentive to invest in, and deliver, effective environmental management.

Two SOMERSGA II indicators relate to "Tourism and Recreation". The two indicators: (1) "Number of independently certified coastal/marine nature tourism guides" and; (2) "Number of dive boats registered" are described below in this Chapter.

Other "Tourism and Recreation" indicators that could be considered for SOMERSGA III could include: (1) Extent of public beaches[63]; (2) Extent of Corniches; (3) Registered hotel beds; (4) Registered dive operators; (5) Registered live aboard boat beds; (6) Accommodation, tour, and other tourism and recreation "green" taxes; (7) Public (tourism and recreational) environment satisfaction survey results.

Recommendations

Given the limited information obtained for SOMERSGA II on the two SOMERSGA II indicators specified for "Tourism and Recreation", and taking note of the suggestions above, for additional indicators,, it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

27.1 Independently certified coastal/marine nature tourism guides

"*Independently certified coastal/marine nature tourism guides*" is a SOMERSGA II indicator. This indicator was ranked 19th out of 31 for 41 indicators with an environmental weighting of 6.8 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

An independently certified coastal/marine nature tourism guide would be an individual who would be certified to guide tourists to see nature in an environmentally responsible way.

(63) Criterion 30 for Blue flag beaches (SOMERSGA II indicator) includes "*Access to the beach should preferably be free, although at some beaches public access is provided through charging a small and reasonable fee*".

Numbers of certified coastal/marine nature tourism guides provides an indication of the level of business linked to nature tourism, and the level of management of the business. The more certified coastal/marine nature tourism guides that there are the more likely it is to lead to improved management of the coastal and marine environment.

Unfortunately, it has not been possible to obtain any information on "I*ndependently certified coastal/marine nature tourism guides*" in the RSGA for SOMERSGA II including confirmation as to whether, or not, such certification exists.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "*Independently certified coastal/marine nature tourism guides",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

27.2 Number of registered dive boats

"*Number of registered dive boats*" is a SOMERSGA II indicator. This indicator was ranked 22nd out of 31 for 41 indicators with an environmental weighting of 6.53 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

A registered dive boat is a boat that is licensed to take out, and provide dive boat services to, snorkelers and SCUBA divers.

"*Number of registered dive boats*" provides an indication of the level of business linked to nature tourism.

Unfortunately, it has not been possible to obtain any information on "*Number of registered dive boats*" in the RSGA for SOMERSGA II including confirmation as to whether, or not, such a form of registration exists.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "*Number of registered dive boats",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

Chapter 28: Desalinization

"*Desalinization*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

One SOMERSGA II indicator relates to "desalinization capacity" and is described below in this Chapter.

Recommendations

Given the limited information obtained on the SOMERSGA II "Desalinization capacity" indicator described below, and the possibility that other "Desalinization" indicators should be considered it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

28.1 Desalinization capacity

"*Desalinization capacity*" is a SOMERSGA II indicator. This indicator was ranked 21st out of 31 for 41 indicators with an environmental weighting of 6.73 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Natural sources of freshwater are insufficient to provide the basic needs of an increasing coastal population let alone the rising demand driven by increasing wealth. Desalinization meets these additional water needs. However, there are costs. Desalinization infrastructure is vulnerable. Desalinization uses large amounts of energy. Currently much of that energy is provided by the burning of fossil fuels so contributing to the greenhouse gas emissions driving climate change. Desalinization also results in the release of additional pollutants, to greenhouse gasses, including thermal pollution. Desalinization also supports higher human populations that drive increasing pressure on coastal resources. Whilst an increase in desalinization capacity may be beneficial to human quality of life it has an adverse impact on the RSGA SOMER and so an increase in desalinization capacity is considered to contribute to RSGA SOMER deterioration.

Information that is available to SOMERSGA II on "*Desalinization capacity*" is presented in the box below.

SOMERSGA II INDICATOR: DESALINIZATION CAPACITY

Djibouti, 2017: Doraleh neighbourhood. A proposed desalination plant will initially have a capacity of 22,500 m3 /day with plans to extend production to 45,000 m3/day. In addition, a 5,000 cubic metre storage tank and a 8.5 km-long pipeline of 700 mm of diameter will be built to connect the plant to the city's public water system. The works will begin immediately and last three years. The consortium will then operate the plant for a five-year period(64) .

Egypt undated: Nearly all coastal resort developments in the Egyptian Red Sea, that are not on mains water supply, have their own desalination plants. In 2003 two pipelines were delivering freshwater from the Nile to parts of the Red Sea Governorate coastal region(65) . The status of desalinated water supply to Hurghada is not known. A desalination plant in Nabq near Sharm-el-Sheikh provides 18,000m3 of desalinated water a day(66) .

Jordan 2017: The Kingdom's first water desalination plant opened in Aqaba Saturday, set to work at a capacity of 500 cubic metres per hour, the Jordan News Agency, Petra, reported. Project to meet Aqaba's water needs until 2035(67) . Plans to build a Red-Sea to Dead Sea canal to provide the energy to desalinate Red Sea water and to raise the level of the Dead Sea in Jordan have been proposed for twenty or more years and are still to come to fruition.

Saudi Arabia 2019: Desalination capacity for the entire Kingdom has reportedly increased by 118% from 827.5 x 106 m3 in 2000 to 1803.1 x 106 m3 in 2018. 13 desalination plants are reported from the Saudi Arabian Red Sea(68) . There are substantial pending upgrades of a number of these including: Haql 4 – 7,500m3/day(69) , Yanbu 4 – 450,000m3/day(70) , Rabigh 3 – 600,000m3/day(71) , Jeddah 4 – 400,000m3/day(72) , Shuaiba 3 – 250,000m3/day(73) .

Somalia 2019: No large-scale desalination plants have been identified for Somalia. Opportunities for investment are limited by the security situation.

Sudan 2019: A desalination plant was built in 2004 with a freshwater production capacity of 7,500 m³. Its current status is unknown(74) . The Port Sudan area in Sudan reportedly contains several small desalination plants(75) . As far as can be determined no large-scale desalination plants are planned for the Sudanese Red Sea.

Yemen 2016: No large-scale desalination plants have been identified in Yemen. A plant near Mocha in Yemen is reported to have been damaged in the current situation(76) . Opportunities for investment are limited by the security situation.

Recommendations

Given the limited information for SOMERSGA II on SOMERSGA II indicator "*Desalinization capacity",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

(64) https://www.waterworld.com/articles/wwi/2017/08/french-spanish-partnership-to-deliver-djibouti-s-renewable-desalination-plant.html
(65) https://www.researchgate.net/publication/228492616_Desalination_option_within_water_demand_management_and_supply_for_Red_Sea_Coast_in_Egypt
(66) https://www.desalination.biz/59365/case-studies/Metito-Case-Study-Seawater-Desalination-Plant-Sharm-El-Sheik---Egypt/4042
(67) http://www.jordantimes.com/news/local/jordan%E2%80%99s-first-water-desalination-plant-opens-aqaba
(68) https://www.swcc.gov.sa/english/Projects/DesalinationPlants/Pages/default.aspx
(69) https://www.protenders.com/projects/haqil-desalination-plant-phase-4
(70) https://www.meed.com/saudi-arabia-receives-expressions-interest-yanbu-4-desalination-project/
(71) http://www.globalconstructionreview.com/news/saudi-arabia-awards-contract-worlds-largest-desali/
(72) https://www.protenders.com/projects/jeddah-4-desalination-plant
(73) https://www.desalination.biz/59365/case-studies/Metito-Case-Study-Seawater-Desalination-Plant-Sharm-El-Sheik---Egypt/4042
(74) https://postconflict.unep.ch/publications/sudan/12_marine.pdf
(75) http://www.euromec.net/en/doc-s-67-972-1-port_sudan_desalination_of_water_from_the_red_sea.aspx
(76) https://www.bellingcat.com/news/mena/2016/12/01/update-bombed-water-desalination-plant-al-mocha-yemen/

Chapter 29: Use of Marine Genetic Resources

"*Use of Marine Genetic Resources*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

No SOMERSGA II indicators have been proposed for "*Use of Marine Genetic Resources*".

There are no reports of substantial investments/research in the use of marine genetic resources in the Red Sea and Gulf of Aden available to SOMERSGA II. Use of marine genetic resources, for example, comprise: (1) the development of antibiotics; (2) use of disease resistant and/or high growth species, or strains of species, for aquaculture; (3) using climate adaptive or resilient species, or strains of species, for restoration (for example to restore coral reef areas following coral bleaching); (4) for Genetic modification through selective breeding, or gene manipulation, to build resilience and adaptive capacity in hard corals and other species to bleaching, or disease resistance and increased production in aquaculture species.

Recommendations

Given that no SOMERSGA II indicators have been specified for "Use of Marine Genetic Resources" it is recommended, in preparation for SOMERSGA III, taking note of the above suggestions, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 30: Marine Scientific Research

"*Marine Scientific Research*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016). This Chapter has close links with Chapter 33 "*Capacity-Building in relation to Human Activities Affecting the Marine Environment*".

No SOMERSGA II indicators have been proposed for "*Marine Scientific Research*".

There is, without doubt, extensive "*Marine scientific research"* going on in the RSGA region. The 2019 Springer published book "*Oceanographic and Biological Aspects of the Red Sea*" edited by Najeeb M.A. Rasul and Ian C.F. Stewart provides a useful introduction. However, there is little co-ordination of research in respect of, either key possible RSGA SOMER indicators, or emerging issues relating to these indicators.

The compilation of all "*Marine scientific research*" in the RSGA region would be a huge, and ever changing, undertaking. It is, therefore, suggested that any inventory of "*Marine Scientific Research*", for SOMERSGA III, should focus on research designed to inform SOMERSGA III indicators including any SOMERSGA III "*new issues*" indicators.

The "Marine scientific research" should also inform the Driver, Pressure, State, Impact, Response (DPSIR[77]) model of environmental management where the drivers include climate change and population growth, and the management response delivers sustainable resource use and as has been adopted in WOA II (UN, 2020).

Recommendations

Given that no SOMERSGA II indicators have been specified for "Marine scientific research" it is recommended, in preparation for SOMERSGA III, taking note of the above suggestions, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

(77) https://www.eea.europa.eu/publications/92-9167-059-6-sum/page002.html

Chapter 31: Conclusions on Other Human Activities

"Conclusions on Other Human Activities" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

"Conclusions on Other Human Activities" comprise conclusions on the status of the indicators assessed in Part V "Assessment of Other Human Activities and the Marine Environment" presented in Chapters 17 through 30 of this SOMERSGA II report as described above.

Notwithstanding the development concerns and discrepancy in institutional capacities among countries of the region, the Red Sea and Gulf of Aden is undergoing rapid transformation from regional trade, subsistence agriculture, animal husbandry, and fishing dependent economies to urban, transnational trade and tourism services-based economies.

Rapidly growing coastal populations and climate change are putting pressure on living marine resources with a lag in the delivery of the social, economic and environmental infrastructure needed to manage these pressures. There is ongoing and potentially irreversible damage to certain living marine resources, most particularly to coral reefs and associated fisheries, and increased risk to human wellbeing, from this lag.

The evidence base for Part V indicators for the SOMERSGA II is relatively limited. Any conclusions that can be drawn are presented in the Summary in Part I and in Chapter 54 of this SOMERSGA II report.

Any positive trends should not be a basis for complacency: (1) because of the lag between the rapid pace of coastal development and the introduction of effective environmental management and; (2) because negative climate change impacts are projected to be both incremental and of increasing frequency in the coming decades.

Chapter 32: Capacity-Building in Relation to Human Activities Affecting the Marine Environment

"*Capacity-Building in Relation to Human Activities Affecting the Marine Environment*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

The most significant regional initiative relating to capacity building in human activities affecting the marine environment is in the PERSGA region is the SEM Project. The SEM Project is described earlier in Chapter III.

Whilst all the indicators in this SOMERSGA II report have capacity building requirements four SOMERSGA II indicators are assessed under this Chapter because they have cross-cutting application to all the SOMERSGA II chapters. The indicators include "*Ratified Multilateral Environmental Agreements*", "*Legally recognized (coastal and) marine protected areas*"; "*Protected Area Management Effectiveness (PAME)",* and "*Blue Flag Compliant Beaches*".

Figure 14. PERSGA regional closing workshop of the Strategic Ecosystem based Management Project (SEM), 17-19 December 2018, Hurghada, Egypt.

There is substantial capacity building through a growing network of Universities in the region. An additional indicator, which has not been assessed for SOMERSGA II, but is proposed for SOMERSGA III is "*Tertiary level training*" in the RSGA in disciplines of relevance to SOMERSGA III indicators.

Recommendations

Given the wide-reaching scope of "*Capacity-Building in Relation to Human Activities Affecting the Marine Environment*" , the possible need for additional indicators, and the need to improve reporting on the SOMERSGA II indicators described below, it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

32.1 Ratified Multilateral Environmental Agreements

Background

"Ratified Multilateral Environmental Agreements" is a SOMERSGA II indicator. This indicator was ranked 14th out of 31 for 41 SOMERSGA II indicators with a score of 7.2 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Figure 15. MEA negotiation training in Djibouti April 2018

PERSGA, the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden, is an intergovernmental body dedicated to the conservation of the coastal and marine environments found in the Red Sea, Gulf of Aqaba, Gulf of Suez, Suez Canal, and Gulf of Aden surrounding the Socotra Archipelago and nearby waters. PERSGA held several workshops addressing MEAs in its member states, including Djibouti, Egypt, Jordan, the Kingdom of Saudi Arabia, Somalia, Sudan and Yemen (Figure 15).

PERSGA's legal basis stems from Article XVI of the Regional Convention for the Conservation of the Red Sea and Gulf of Aden, known as the Jeddah Convention, signed in 1982 (PERSGA, 1982a): "A Regional Organization for the Conservation of the Red Sea and Gulf of Aden Environment, the permanent headquarters of which shall be located in Jeddah, Saudi Arabia, is hereby established". PERSGA was activated by the Cairo declaration in 1995.

This SOMERSGA II report is a response to Article XVIII.f of the Jeddah Convention "To review and evaluate the state of the marine environment and coastal areas on the basis of reports provided by the Contracting Parties, or by the international organizations concerned".

Methodology

PERSGA maintains a list of multilateral environmental agreements, the Jeddah Convention, Protocols and which of the 7 national parties to the Jeddah Convention have ratified them. The analysis comprises a comparison of the number of ratifications prior to 2006 compared with the number ratified between 2006 and 2018. The list comprises 44 multilateral environmental agreements plus the Jeddah Convention and its four Protocols[78].

STATUS

The results of the analysis are shown in Figure 16 below.

The Nairobi Convention on the removal of wrecks (2007), the Jeddah Convention Protocol relating to technical cooperation in cases of emergency (2009), the Nagoya Protocol (2010), the Minamata Convention on Mercury (2013), and the Paris Agreement (2015) were all created after 2005.

(78) There are 7 nations (Djibouti, Egypt, Jordan, Saudi Arabia, Somalia, Sudan and Yemen) that are party to the Jeddah Convention. The potential number of ratifications is, therefore 7 x the number of MEAs.

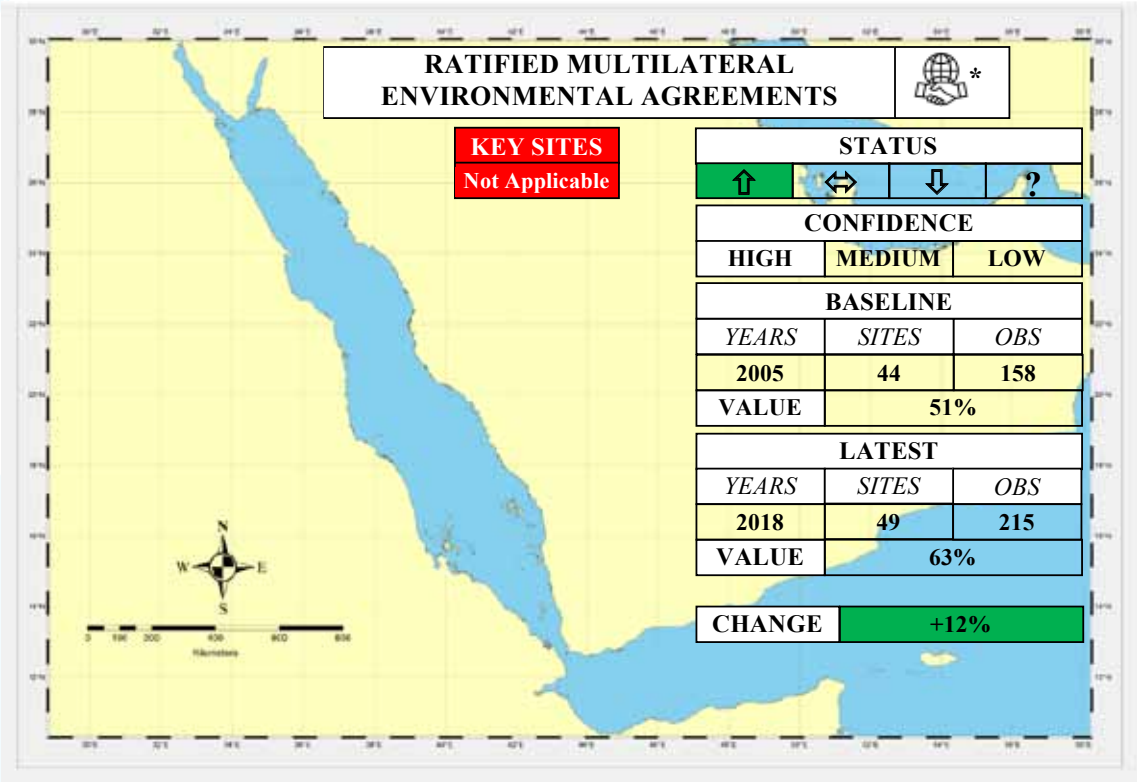


*Figure 16: Status of SOMERSGA indicator – Ratified Multilateral Environmental Agreements (OBS = Observations; *icon made by Freepik from www.flaticon.com;)*

There were 158 of a possible 308 ratifications (51%) of 44 MEAs by 2006 and 215 of a possible 343 ratifications (63%) of 49 MEAs by 2018. This represented a 12% increase in ratifications (57 ratifications) between 2006 and 2018 (figure 16).

Key issues

Six key issues are idenhfied.

1. Ratifications of MEAs by RSGA countries are still relatively low (63% of possible ratifications), though still a significant 12% increase reported since the last SOMER 2006.
2. None of the parties to the Jeddah Convention has ratified the "*Protocol Concerning Technical Cooperation to Borrow and Transfer Experts, Technicians, Equipment and Materials in Cases of Emergency, Adopted in Jeddah on 1st July 2009*".
3. Four of the seven Parties to the Jeddah Convention have ratified the "*Protocol concerning the conservation of Biological Diversity and Establishment of Network of Protected Areas in the Red Sea and Gulf of Aden Adopted in Jeddah on12 December 2005*". The Protocol has entered into force because at least four parties have ratified the Protocol, but the remaining three parties still have to do so. Annexes 1 and 2 of the Protocol need to be completed.
4. Four of the seven Parties to the Jeddah Convention have ratified the "*Protocol Concerning the Protection of the Marine Environment from Land Based Activities, Adopted in Jeddah on 25th September 2005*". The Protocol has entered into force because at least four parties have ratified the Protocol, but the remaining three parties still have to do so.
5. The contaminants/source categories in the GPA (UNEP, 1995) should be reviewed, revised as necessary, and agreed, and entered into Annexes I and III of the Jeddah Convention LBA Protocol (PERSGA, 2005a).
6. The boundary coordinates of a number of protected areas within the PERSGA region are unspecified or unclear.

Recommendations

1. Parties to the Jeddah Convention should move to ratify MEAs that are relevant to delivering the Jeddah Convention and its protocols.
2. Ratifying parties to the Protected Areas Protocol under the Jeddah Convention should advise PERSGA of requirements regarding Annexes 1 and 2 of the Protocol specified in item 3 relating to the Protected Areas Protocol above[79].
3. Ratifying parties to the Protected Areas Protocol under the Jeddah Convention should, where they have not done so, deposit legal documents with PERSGA specifying the terrestrial, coastal, and marine boundaries of biodiversity protected areas within their EEZ[80].
4. PERSGA should seek clarification from the Secretariat to the Convention on Biological Diversity on the definition of "coastal" in respect of the definition of marine and coastal areas under the Aichi target 11 and any subsequently agreed targets using the term "coastal and marine".
5. The contaminants/source categories in the GPA (UNEP, 1995) should be reviewed, revised as necessary, and agreed, and entered into Annexes I and III of the Jeddah Convention LBA Protocol (PERSGA, 2005a).
6. Boundary coordinates for a number of protected areas within the PERSGA region should be specified/made clear.
7. PERSGA should deliver a RSGA SOMERSGA III report to include an assessment of MEA ratifications and delivery of recommendations 1 through 6 by the end of 2025.

32.2 Legally recognized (coastal and) marine protected areas

Background

Figure 17. View from Sanganeb lighthouse: Sanganeb Marine National Park and Dungonab Bay – Mukkawar Island Marine National Park World Heritage Site, Sudan; (credit: Olya Wedder).

"Legally recognised Coastal[81] and marine biodiversity protected areas" is a SOMERSGA II indicator.

(79) The Annexes 1 (threatened species) and 2 (Species whose exploitation is regulated) are not currently provided in the Jeddah Convention "Protocol concerning the conservation of Biological Diversity and Establishment of Network of Protected Areas in the Red Sea and Gulf of Aden Adopted in Jeddah on12 December 2005".
(80) Direct submission of this information to the World Database on Protected Areas would also be appropriate.
(81) The Aichi target is for coastal and marine areas but coastal areas have not been clearly defined and so these areas cannot be analysed accordingly in terms of coverage (see discussion).

1. Aqaba Marine Park, Jordan; 2. Abu Galum Protectorate, Egypt; 3. Nabq Protectorate, Egypt; 4. Ras Mohamed National Park and nominated World Heritage Site, Egypt; 5. Red Sea Northern Islands, Egypt; 6. Wadi El-Gemal-Hamata National Park, Egypt; 7. Elba National Park, Egypt; 8. Sanganeb Marine National Park and Dungonab Bay – Mukkawar Island Marine National Park and World Heritage Site, Sudan; 9. Umm al-Qamari Islands Special Nature reserve, Saudi Arabia; 10. Farasan Islands Protected Area and nominated World Heritage Site, Saudi Arabia; 11. North Kamaran Island Protected Area, Yemen; 12. Balhaf/Burum coastal area proposed protected area and nominated World Heritage Site, Yemen; 13. Socotra Archipelago World Heritage Site, Yemen; 14. Iles des Sept Freres ainsi que Ras Syan, Khor Angar et la foret de Godoria Marine Protected Area and nominated World Heritage Site, Djibouti; 15. Iles Musha et Maskhali Marine Protected Area and nominated World Heritage Site, Djibouti; 16. La plage d'Arta proposed protected area, Djibouti; 17. Haramous-Loyada Marine Protected Area, Djibouti; 18. Aibat and Saad ad-Din Islands, Saba Wanak proposed protected

Figure 18: Protected areas in the Red Sea and Gulf of Aden as of 2019. Basemap courtesy of Google Earth.

This indicator was ranked 2nd out of 31 indicators with an environmental weighting of 8.8 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Article 8 of the Convention on Biological Diversity (CBD), which has been ratified by Djibouti, Egypt, Jordan, Saudi Arabia, Somalia, Sudan and Yemen, relates to in-situ conservation to be delivered within biodiversity protected areas.

In addition, the Jeddah Convention, under which this SOMERSGA II is commissioned, includes "The Protocol Concerning the Conservation of Biological diversity and the Establishment of a Network of Protected Areas in the Red Sea and Gulf of Aden" (PERSGA, 2005b). Djibouti, Jordan, Saudi Arabia and Sudan have acceded to the Protocol whilst Egypt, Somalia and Yemen have not.

At the 10th meeting of the Conference of the Parties to the CBD in Nagoya, Japan, in 2010 the Parties adopted a 10-year Strategic Plan for Biodiversity 2011-2020 to achieve 20 Aichi Biodiversity Targets. Target 11 requires that the biodiversity of 10 per cent of coastal and marine areas is effectively protected by 2020. The SOMERSGA II indicator "Marine Biodiversity Protected Area" provides the area against which delivery of this target can be assessed. In principle it can be assumed that an increase in coverage is likely to contribute to an improved SOMERSGA. The "Legally recognised (coastal) and marine protected area" SOMERSGA indicator assessed in this sub-chapter is closely associated with the "Protected Area Management Effectiveness (PAME)" SOMERSGA indicator described in sub-chapter 32.3 below.

Methodology

The methodology used was to source the legislation on biodiversity protected areas within the Red Sea and Gulf of Aden and determine the date of designation, the location, and the area covered (PERSGA, 2019a,b). Area of coverage, so determined, was then compared between a baseline period (prior to the last SOMER in 2006) and in 2018.

Information was obtained on 15 legally recognised coastal and marine protected areas associated with the 7 PERSGA member countries. It can be assumed that the list covers nearly all such legally recognised areas in the RSGA. However, there may be omissions(82), (83), (84), (85). Any omissions should be notified to PERSGA.

(82) Sanganeb National Park and Dungonab Bay - Mukkawar Island Federal Reserve were assimilated, as core zone properties, into the Sanganeb Marine National Park and Dungonab Bay – Mukkawar Island Marine National Park World Heritage Site in 2016.
(82) Legal recognition of La plage d'Arta in Djibouti is pending (MHUE, Pers. Comm. Aden Elmi, Conseiller Technique).
(82) Legal recognition of Balhaf/Burum coastal area in Yemen is still pending (YLNGC, 2015)
(82) Legal recognition of Aibat and Saad ad-Din Islands, Saba Wanak in Somalia is still pending

Status

The results of the assessment on protected area coverage in the PERSGA region are summarised in Figure 19 below (key sites are from figure 18 above).

Improvements since 2005 include:

i. *Two new coastal and marine protected areas:*

Red Sea Northern Islands Protected Area, in Egypt, was declared in 2006 (GoE, 2006) Northern Kamaran Island Protected Area, in Yemen, was declared in 2009 (GoY, 2009).

ii. *Designation of 2 coastal and marine protected areas as World Heritage Site's:*

All PERSGA member countries other than Somalia have ratified the World Heritage Convention. Two coastal and marine biodiversity protected areas in the RSGA have been inscribed as World Heritage status since 2005 namely Socotra Archipelago in Yemen in 2008[86] and Sanganeb Marine National Park and Dungonab Bay – Mukkawar Island Marine National Park in Sudan in 2016[87].

Three sites in the RSGA region have been nominated for World Heritage Site listing since the last SOMERSGA I in 2005 (PERSGA, 2006): (1) Farasan Islands in Saudi Arabia in 2019; (2) Iles Musha et Maskhali MPA in Djibouti in 2015; (3) Ile des Sept Freres ainsi que Ras Syan, Khor Angar et la foret de Godoria MPA (under the Les paysages naturels de la région d'Obock) in Djibouti also in 2015.

Ras Mohamed in Egypt and Balhaf/Burum coastal area in Yemen were nominated as World Heritage Sites before the last SOMERSGA I in 2005 (PERSGA, 2006), namely in 2002. These nominations are still pending inscription.

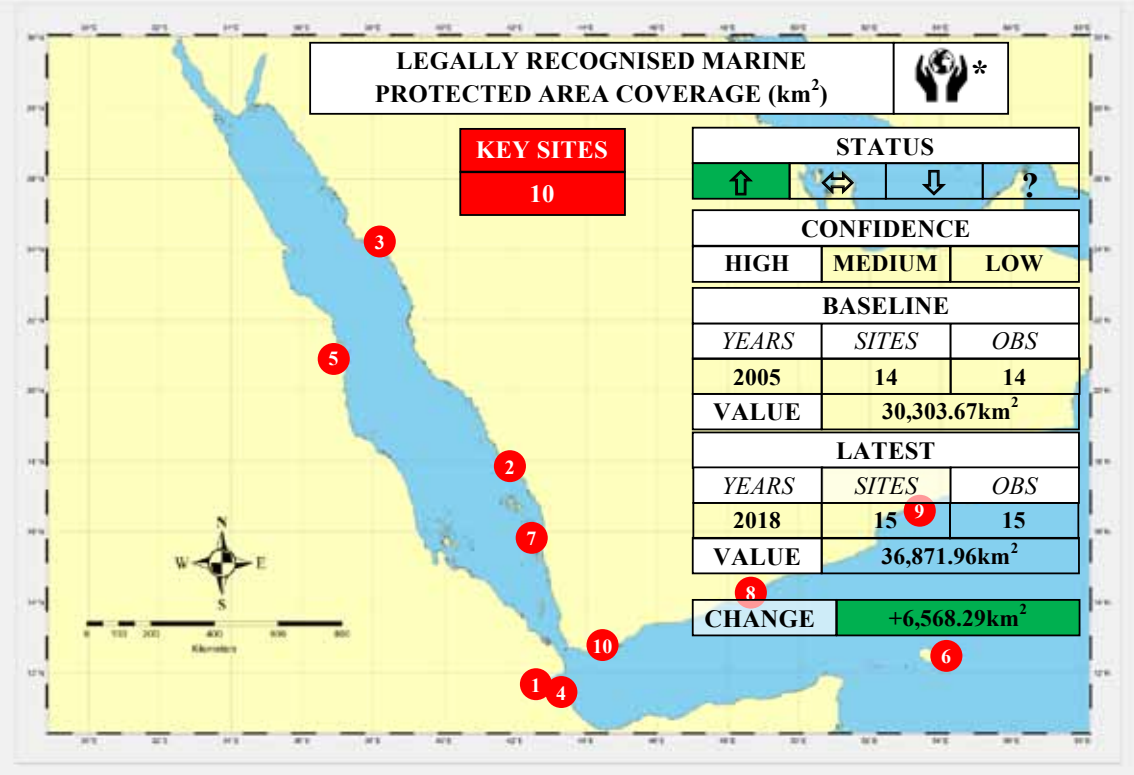


*Figure 19: Status of SOMERSGA indicator – Legally Recognised Marine Protected Area Coverage in km² (OBS = Observations: *icon made by Freepik from www.flaticon.com;)*

(86) https://whc.unesco.org/en/list/1263/
(87) https://whc.unesco.org/en/list/262

iii. Increase of 21.67% marine protected area coverage:

The analysis shows an overall increase of 6568.29km^2 (21.67%) in **marine** protected area between 2006 and 2018. The increase in marine protected area is due to four contributions:

(1) the 2008 inscription of Socotra archipelago as a World Heritage Site (309.61km^2);

(2) the 2016 inscription of Sanganeb Marine National Park and Dungonab Bay – Mukkawar Island Marine National Park as a World Heritage Site (4,580.13km^2);

(3) the legal designation of the Red Sea Northern Islands protected area in Egypt in 2006 (1663.93km^2); and:

(4) the legal designation of North Kamaran Island Protected Area in Yemen in 2009 (14.62km^2).

iv. Aichi target:

The % of the EEZ that is legally designated as marine biodiversity protected area is approximately 4.5%[88], which is less than half of the 10% Aichi target 11 due by 2020. This 4.5% figure excludes coastal protected areas above high-water mark since coastal area is not clearly defined and measured (see discussion). If the terrestrial protected area, adjacent to marine protected area, is included then this adds another 32846.65m^2 and 8.6% coverage[89] which is, also, below the 10% target.

Discussion

There is a positive trend for marine biodiversity protected area coverage in the Red Sea and Gulf of Region and a general improvement in protected areas management effectiveness (see sub-chapter 32.3 below). However, there are significant risks from climate change and human population growth that will need to be managed globally as well as locally if these protected areas are to be effective in helping to maintain the biodiversity of the marine environment.

The Aichi target 11 relates to coastal and marine areas but does not clearly define them. Where figures are given for protected areas coverage in the RSGA, they distinguish terrestrial from marine areas with the boundary usually being high water mark but the figures do not distinguish a "coastal" sub-category of terrestrial coverage.

The definition of geographic coverage under the Jeddah Convention specifies "*…entire sea area, taking into account integrated ecosystems…".* The Jeddah Convention "*Protocol Concerning the Protection of the Marine Environment from Land Based Activities"* adds the clarification that the coverage "*includes the coastal brackish water as well as the coastal swamps and lagoons, groundwater and water basins embodying the coastal collected waters*" (PERSGA, 2005a). *The Jeddah Convention "Protocol concerning the conservation of Biological Diversity and Establishment of Network of Protected Areas in the Red Sea and Gulf of Aden" does not provide clarification of what a coastal area might be (PERSGA, 2005b).*

Key sites

Ten key sites are identified in figure 19 above (numbers refer) and detailed below.

1. Djibouti: La Plage d'Arta in Djibouti is pending legal recognition of the need for the additional protection of whale shark aggregations.
2. Saudi Arabia: The Farasan Islands were nominated as a World Heritage Site in January 2019 and will, hopefully be accepted on the inscribed list.
3. Saudi Arabia: The turtle nesting beaches at Ras Alaquqe/Baridi north of Yanbu are regionally significant but are not designated as biodiversity protected areas.

(88) The total area of the EEZ within the RSGA under the Jeddah Convention is estimated at 810,952.93km2 (Flanders Marine Institute (2018). Maritime Boundaries Geodatabase, version 10. Available online at http://www.marineregions.org/, Klaus, R. et al. (in prep). The marine protected area in the RSGA under countries that have ratified the Jeddah Convention is estimated at 36872.86km2.

(89) Whilst this includes some islands and shorelines it also includes some inland areas which may not be coastal, depending on the definition of coastal.

4. Somalia: Aibat and Saad ad-Din Islands, Saba Wanak in Somalia was nominated as part of the RSGA network of protected areas in 2002 (PERSGA, 2002) but is not yet legally recognised as a biodiversity protected area.

5. Sudan: Sanganeb Marine National Park and Dungonab Bay – Mukkawar Island Marine National Park was inscribed as a World Heritage Site in 2016.

6. Yemen: Socotra Archipelago, in Yemen, was inscribed as a World Heritage Site in 2008. The ongoing instability associated with the current situation could be putting its important biodiversity assets at risk although it is not on the list of World Heritage Sites in danger.

7. Yemen: North Kamaran Island was legally recognised as a coastal and marine biodiversity protected area in 2009. Unfortunately, the current situation in Yemen means that it was not possible to invest in enhancing the biodiversity management of this protected area under the SEM Project.

8. Yemen: Balhaf/Burum coastal area was nominated as a World Heritage Site in 2002 and as part of the RSGA network of protected areas in the same year (PERSGA, 2002) but is not yet legally recognised as a biodiversity protected area. The area includes regionally significant turtle nesting.

9/10. Yemen: The important turtle nesting areas of Ras Sharma and Jabal/Jazirat Aziz should also be considered for protection. The areas contain regionally significant turtle nesting. Their status is a cause of some concern given the ongoing instability associated with the current situation (see the description of the SOMERSGA II “Turtle nesting” indicator in sub-chapter 39.1 below).

Recommendations (country order)

1. Djibouti: La Plage d’Arta in Djibouti is pending legal recognition of the need for the additional protection of whale shark aggregations. Legal recognition should be encouraged.

2. Egypt: Consideration should be given to ratification of the Jeddah Convention Protected Areas Protocol.

3. Saudi Arabia: The Farasan Islands were nominated as a World Heritage Site in January 2019 and their nomination should be supported.

4. Saudi Arabia: The turtle nesting beaches at Ras Alaquqe/Baridi north of Yanbu are regionally significant and should be recognised accordingly.

5. Somalia: Aibat and Saad ad-Din Islands, Saba Wanak in Somalia is pending legal recognition and was nominated as part of the RSGA network of protected areas in 2002 (PERSGA, 2002). Legal recognition should be encouraged and should also be a focus for coastal and marine biodiversity management capacity building efforts in Somalia.

6. Somalia:Consideration should be given to ratification of the Jeddah Convention Protected Areas Protocol.

7. Sudan: Sanganeb Marine National Park and Dungonab Bay – Mukkawar Island Marine National Park World Heritage Site, in Sudan, should be a national focus for coastal and marine biodiversity management capacity building efforts. The buffer zone is legally binding under the World Heritage Convention, which Sudan has ratified. However, this buffer zone should also be recognised in national legislation.

8. Yemen: Balhaf/Burum, Ras Sharma and Jabal/Jazirat Aziz coastal areas in Yemen should receive legal recognition as coastal and marine biodiversity protected areas.

9. Yemen: Consideration should be given to ratification of the Jeddah Convention Protected Areas Protocol.

10. General: PERSGA should seek clarification from the Secretariat to the Convention on Biological Diversity on the definition of "coastal" in respect of the definition of marine and coastal areas under the Aichi target 11 and any subsequently agreed targets using the term "coastal and marine".

11. General: There should be a concerted effort to clearly survey and nationally gazette the boundaries of marine protected areas, within the PERSGA region where this has not been done, to distinguish terrestrial, coastal and marine components in respect of the Aichi target 11, and to deposit the boundary coordinates with PERSGA and the World Database on protected Areas(90).

12. PERSGA should deliver a SOMERSGA III report to include an assessment of the change in areas legally designated for coastal and marine biodiversity protection in the RSGA region and implementation of recommendations 1 through 11 by the end of 2025.

32.3 Protected Area Management Effectiveness (PAME)

Background

"Protected Area Management Effectiveness (PAME)" is a SOMERSGA II indicator. This indicator was ranked 11th out of 31 for 41 SOMERSGA II indicators with an environmental weighting of 7.4 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

In 2004 the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD) agreed on the need to formally assess the effectiveness with which areas, including marine areas, designated for biodiversity protection are managed.

An assessment of protected area management effectiveness (PAME) was, consequently, included in the CBD's Programme of Work on Protected Areas (PoWPA)(91).

PAME evaluations can be defined as: "*the assessment of how well protected areas are being managed – primarily the extent to which management is protecting values and achieving goals and objectives*" (Hockings et. al., 2006).

Figure 20. Visitor sign board at Wadi El Gemal – Hamata National Park. Rebecca Klaus 2018.

Capacity-building in PAME has been undertaken, in 2017 to 2018, under the World Bank (WB) Global Environmental Facility (GEF) funded Strategic Ecosystem Management (SEM) Project.

Methodology

There are multiple and evolving methods for undertaking PAME evaluations. The method adopted by PERSGA is the MPAs "*Score Card*" system produced in 2004 (World Bank, 2004, see Fig 21).

The MPAs scorecard evaluates 6 elements namely: **Context** – where are we now? **Planning** –

(90) For example: Haramous-Loyada Marine Protected Area Iles des Sept Freres ainsi que Ras Syan, Khor Angar et la foret de Godoria Marine Protected Area and Iles Musha et Maskhali Marine Protected Area under Article 7 of Law 45 of 2004 "The exact boundaries of the protected areas and their management will be determined by regulations".
(91)https://pame.protectedplanet.net

where do we want to be? **Inputs** – what do we need? **Process**: How do we go about it? **Outputs**: What were the results? **Outcome**: What did we achieve? The maximum possible combined score for all 6 elements is 139.

Scorecards were completed, either in a forum guided by relevant experts, or directly by relevant experts.

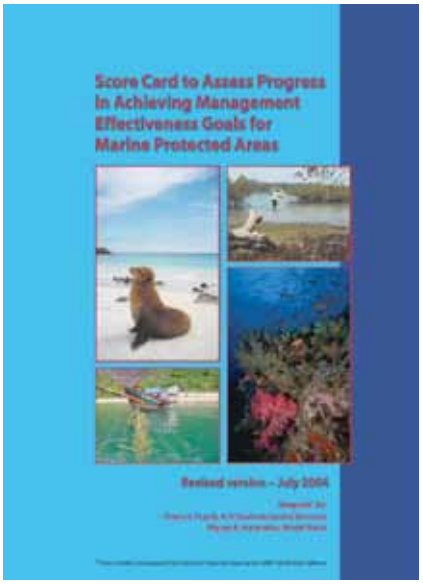


Figure 21. World Bank Protected Area Management Effectiveness scorecard guidelines (World Bank, 2004).

STATUS

The results of the assessments over the period 2015 to 2018 are shown in Figure 22 below[92]. Scorecards were completed for 15 of the 16 legally designated areas in 2015[93], for Dungonab Bay - Mukkawar Island Federal Reserve in Sudan, also in 2016 and 2017, and for 13 of the 16 legally recognised areas in the RSGA region, and in Plage d'Arta in Djibouti, which is pending legal recognition, in 2018[94].

The analysis shows an overall improvement of + 17.4 (13%) in the average score from 61.29 for the 17 assessments at 14 sites in the period 2015 to 2017 (44% of a maximum possible score of 139) to 78.69 for 13 assessments at 13 sites in 2018 (57% of maximum possible score of 139). Ras Mohammed National Park in Egypt achieved the highest score both in 2015 (94) and in 2018 (114). It is also the one coastal and marine biodiversity protected area in the RSGA that is on the Protected planet "Green list[95]".

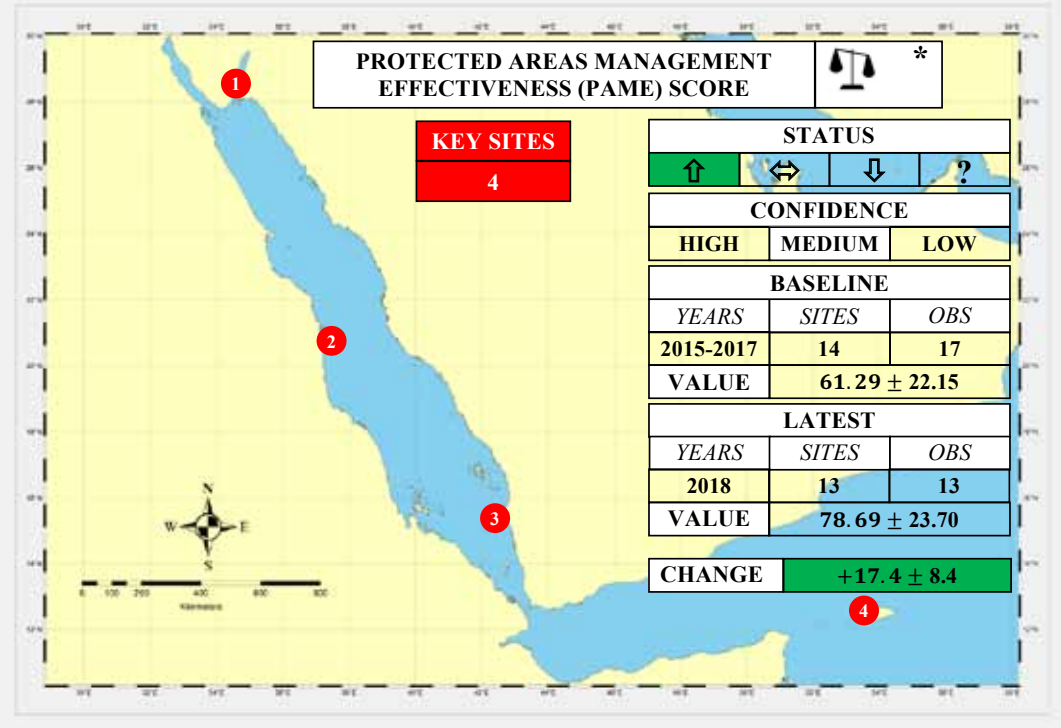


*Figure 22: Status of SOMERSGA indicator - Protected Area Management Effectiveness (PME) Scores- (OBS = Observations; *icon made by Freepik from www.flaticon.com;)*

(92) No MPA management effectiveness scores are available, prior to 2015, for any of the 16 legally recognised coastal and marine biodiversity protected areas, in the 7 PERSGA member countries.
(93) Haramous-Loyoda in Djibouti was not assessed and Plage d'Arta in Djibouti is pending legal recognition and was not assessed (MHUE, Pers. Comm. Aden Elmi, Conseiller Technique 2019). There are no legally recognised coastal and marine biodiversity protected areas in Somalia.
(94) Abu Galoum and Elba, in Egypt were not assessed in 2018 and Plage d'Arta in Djibouti is pending legal recognition (MHUE, Pers. Comm. Aden Elmi, Conseiller Technique 2019) but was assessed. In addition, Socotra Archipelago Protected Area (World Heritage Site) and North Kamaran Island Protected areas in Yemen could not be re-assessed in 2018.
(95) https://www.protectedplanet.net/green_list/ras-mohammed-national-park

Discussion

The fact that the assessments are being undertaken for nearly all the protected areas, and that the scores are increasing, is a positive sign. This situation provides a firm foundation on which to deliver further necessary improvements given that the average score for the 13 sites assessed in 2018 is still only 57% of the maximum.

Key sites

Four key sites are identified (see figure 22 above).

1. Abu Galum, in Egypt, is identified because it has not been possible to obtain a score card for it in 2018.
2. Sanganeb, in Sudan, is identified because it had a relatively low score of 45 in 2018 and, because it also comprises part of the "Sanganeb Marine National Park and Dungonab Bay – Mukkawar Island Marine National Park" World Heritage Site inscribed in 2016.
3. North Kamaran Island in Yemen is identified because no score card was completed for it in 2018 due to instability caused by the current situation. This instability could be putting its important biodiversity assets, including fisheries and stands of *Rhizophora mucronata* mangrove, at risk.
4. Socotra Archipelago, in Yemen, is identified because no score card was completed for it in 2018 due to instability caused by the current situation. Socotra Archipelago is a World Heritage Site inscribed in 2008. The instability could be putting its important biodiversity assets at risk. However, it is not listed as a WHS in danger at this time[96].

Recommendations

1. Training in completing score cards and providing annually completed score cards to the PAME website[97] should be provided.
2. The score card results should be used to realise opportunities and alleviate constraints in the management of coastal and marine biodiversity protected areas in the RSGA region.
3. PERSGA should deliver a SOMERSGA III report to include an assessment of annual score card results for all legally designated coastal and marine biodiversity protected areas in the RSGA region and implementation of recommendations 1 and 2 by the end of 2025.

32.4 Blue Flag Compliant Beaches

Background

"Blue Flag Compliant Beaches" are a SOMERSGA II indicator. The indicator was ranked 24th out of 31 for 41 indicators with an environmental weighting of 6.47 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

The Blue flag scheme is an international initiative designed to improve the environmental

Figure23. Movenpick Tala Bay Jordan Blue Flag 2018. www.blue-flag.com

(96) https://whc.unesco.org/en/danger/
(97) https://pame.protectedplanet.net/

management and consequent environmental quality of beaches and, in particular, those beaches supporting the tourism sector. Beaches complying with the Blue Flag criteria are awarded Blue Flag status.

Thirty-three criteria must be met when the beach is open and flying the blue flag. The criteria cover the themes of: (1) Environmental Education and Information; (2) Water Quality; (3) Environmental Management; (4) Safety and Services[98].

An increase in the number of Blue Flag compliant beaches should both directly, and indirectly, contribute to improvement of the SOMER in the RSGA.

Methodology

The Blue Flag website[99] provides a map (see figure 24) showing all beaches that currently comply with the Blue Flag criteria including those within the RSGA region.

The methodology involves clicking on all sites within the RSGA on the map and noting the details.

Figure 24. Map of Blue Flag locations available from/courtesy of https://www.blueflag.global/

Status

Three beaches in the RSGA have Blue Flag Beach Status. All beaches obtained Blue Flag Status in 2011 and all are located within Jordan (see figure 25).

Key sites

Achieving Blue Flag status is generally not easy. However, the three locations along the 35km shoreline of the Jordanian Gulf of Aqaba have achieved Blue Flag compliance despite an extremely high density of multiple use including Ports and Harbours, fishing, residential, recreational, tourism and biodiversity conservation. The three sites, consequently, provide a particularly good practice example for the RSGA region.

Recommendations

1. Signatories of the Jeddah Convention should facilitate and encourage delivery of Blue Flag certified beaches so as to improve the SOMER of beaches and associated habitats specifically and the SOMER of the RSGA generally.
2. PERSGA should deliver a SOMERSGA III report to include an assessment of delivery of recommendation 1 by the end of 2025

(98) https://www.blueflag.global/s/Beach-Criteria-and-Explanatory-Notes-2018-kwpp.pdf
(99) https://www.blueflag.global/

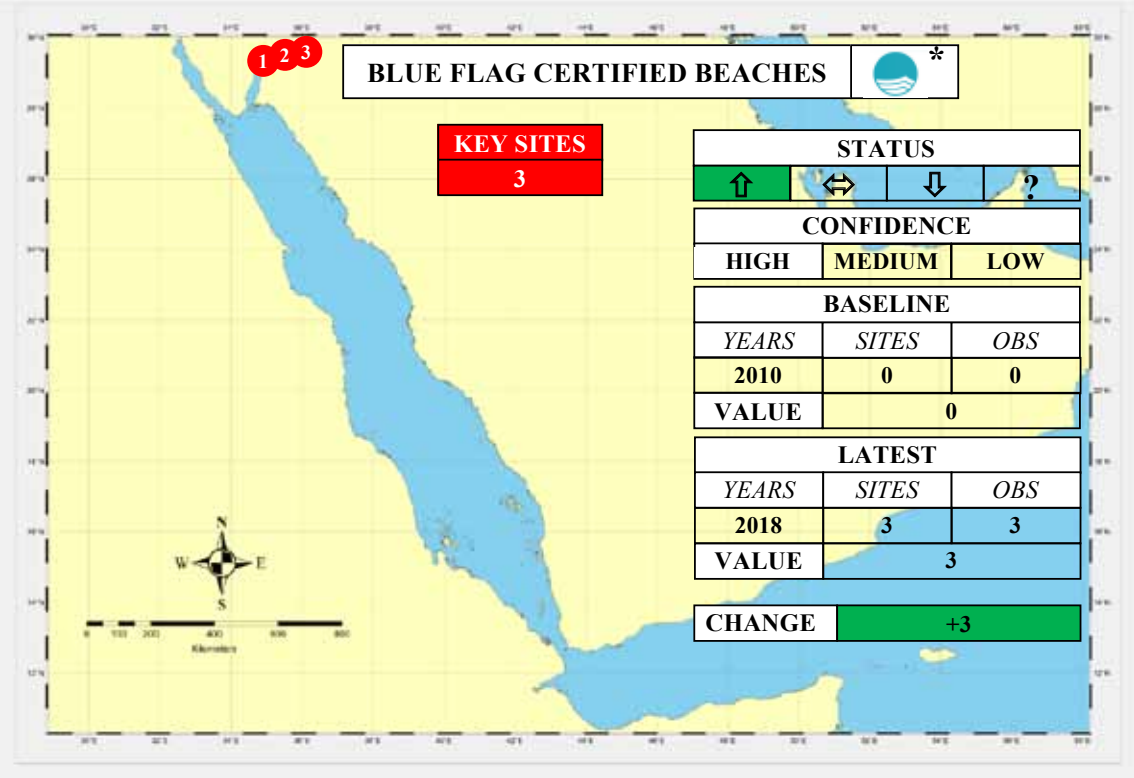


*Figure 25: Status of SOMERSGA indicator – Blue Flag Certified Beaches (OBS = Observations; * icon courtesy of https://www.blueflag.global/)*

32.5 Tertiary level training (Not assessed under a SOMERSGA II indicator)

There is substantial capacity building through a growing network of Universities in the RSGA region. An additional indicator, which has not been assessed for SOMERSGA II, but is proposed for SOMERSGA III is “Tertiary level training” in the RSGA in disciplines of relevance to SOMERSGA III indicators.

Given that no SOMERSGA II indicators have been specified for “Tertiary level training” it is recommended, in preparation for SOMERSGA III, that the “key recommendations” process presented in Part I is followed to identify indicators and their means of objective and quantitative verification.

Figure 26. numbers of training workshops and participants in PERSGA biennial training program during 2005-2018

There has been positive trend for "Capacity-Building in Relation to Human Activities Affecting the Marine Environment" provided through PERSGA training programmes. The numbers of training events and beneficiaries, including gender indicators, and the range of subjects triggered has significantly been extended during the past 20 years (Fig 26). Many of these training workshops followed a "Training Of Trainers (TOT)" approach, and produced focused guidelines to support capacity building at national, and local, levels. These capacity building initiatives should be monitored and evaluated so as to inform the delivery of improved environmental conservation, particularly in respect of SOMERSGA III indicators. Monitoring and evaluation should also consider gender balance.

Part VI ASSESSMENT OF MARINE BIOLOGICAL DIVERSITY AND HABITATS

Chapter 33: Introduction

"*Introduction*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016). The following is extracted from the Chapter 33.

> "The biodiversity of the world's oceans directly supports many of the services and industries reviewed in Parts III, IV, and V, and may be affected by how the various social and economic benefits are used. To ensure the ongoing availability of those benefits to current and future generations, and to maintain healthy oceans, it is essential that the uses made of the ocean are sustainable, both individually and in the aggregate. In Part VI we examine ocean biodiversity from several perspectives, and when trends are apparent, link those trends to their main drivers" (UNGA, 2016).

Section A – Overview of Marine Biological Diversity

Chapter 34: Global Patterns in Marine Biodiversity

"Global Patterns in Marine Biodiversity" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

There is no SOMERSGA II indicator related to "Global Patterns in Marine Biodiversity".

The centre of global marine biodiversity occurs in the "coral triangle" in East Asia. However, the marine biological diversity and habitats of the Red Sea and Gulf of Aden are globally significant in the history of their exploration and scientific investigation, the extent of their coral reefs and in the degree of endemism, particularly of coral reef fish.

Recommendations

Given the lack of SOMERSGA II indicators for "*Global patterns in Marine Biodiversity",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify indicators and their means of objective and quantitative verification.

Chapter 35: Extent of Assessment of Marine Biological Diversity

"Extent of Assessment of Marine Biological Diversity" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

There is no SOMERSGA II indicator related to "*Extent of Assessment of Marine Biological Diversity*".

The Red Sea and Gulf of Aden has a long history of scientific research into biological diversity starting with the studies of Forskål in the 18th century (1700's). These studies have been supplemented by research undertaken by visitors from outside the region and by Universities and

Marine Science Stations based in the Red Sea area. Comment on Marine Scientific Research is presented in Chapter 30 of this SOMERSGA II.

Recommendations

Given the lack of SOMERSGA II indicators for "*Extent of Assessment of Marine Biological Diversity",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify indicators and their means of objective and quantitative verification.

Chapter 36: Overall Status of Major Groups of Species and Habitats

"Overall Status of Major Groups of Species and Habitats" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

There is no SOMERSGA II indicator related to "*Overall Status of Major Groups of Species and Habitats*". However, overall status is a product of the individual assessments presented in Chapters 37 through 51 of this SOMERSGA II report.

Figure 27. Coral reefs at Sanganeb National Park, Sudan, Red Sea. (Credit: PERSGA)

Section B – Marine Ecosystems, Species and Habitats Scientifically Identified as Threatened, Declining or otherwise in need of Special Attention or Protection.

I. Marine Species

Chapter 37: Marine Mammals

"Marine Mammals" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

"*Dugong*" are "*Marine Mammals*" and are a SOMERSGA II indicator. The status of "*Dugong*" is presented below.

"*Cetaceans*" (whales and dolphins) are "*Marine Mammals*". "*Cetaceans*" are not specified as a SOMERSGA II indicator. A survey of Cetaceans in the RSGA was published in 2017 (Notarbartolo et. al., 2017).

Recommendations

Given the limited information obtained for SOMERSGA II indicator *"Dugong", and the lack of SOMERSGA II indicators for "Cetaceans",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed for "Dugong" and to identify "*Cetaceans*" indicators and their means of objective and quantitative verification.

37.1 Dugong

Background

"*Dugong*", *Dugong dugon,* occurrence is a SOMERSGA II indicator (Fig 28). This indicator was ranked 11th out of 31 for 41 indicators with an environmental weighting of 7.4 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Dugong are indicated to be vulnerable in the IUCN Red List (Marsh, H. & Sobtzick, S. 2015), are on Appendix I of CITES, and are on appendix II of the CMS/Bonn Convention(100).

All Jeddah Convention signatories have ratified the CITES(101) and CMS/Bonn Conventions.

Figure 28. Feeding dugong, 25th March 2015. Marsa Mobarak, Egypt. Dr Ahmed M., Shawky, EEAA, Red Sea Protectorates.

National reports(102) based on the CMS/Bonn Convention "Dugong" Memorandum of Understanding have been produced in 2017 by Egypt, Jordan, Saudi Arabia, Somalia, and Sudan. They have not been produced for Djibouti, and Yemen.

There is little information on the migration of dugongs in the RSGA. One report indicates the maximum distance travelled by any dugong observed during the study was 36km. However, no observation period was specified in respect of any individual (Shawky, et. al., 2017).

(100) https://www.cms.int/en/species/dugong-dugon. Appendix II covers migratory species that have an unfavourable conservation status.
(101) https://speciesplus.net/#/taxon_concepts/3515/legal
(102) https://www.cms.int/dugong/en/documents/national-reports.

Dugong are protected in Djibouti[103], Egypt[104], Sudan[105],andYemen[106]. It is indicated that dugong are not legally protected in Jordan because they are not found there (Khalaf, M.A., 2015). Their legal status in Saudi Arabia[107] and Somalia[108] need to be confirmed.

Figure 29. Location of dated and quantified dugong sightings in the PERSGA region.

Methodology

Grey and published literature were searched to source sightings of dugong with abundance, date and location attributes. Only two large studies (Preen, 1989, Shawky, et. al., 2017), and one isolated observation near Al Lith in 2009 (Al-Mansi, A.M.A., 2016) have been sourced.

The distribution of dugong sightings reported from these sources is illustrated in Figure 29 (PERSGA, 2019a, PERSGA, 2019b).

Status

The 1989 survey of the Saudi Arabian Red Sea (Preen, A., 1989) used a light aircraft and shore observations and identified 121 individuals though it is possible that some individuals were double counted. The largest group reported was 6. 3 groups of 4, 4 groups of 3, 19 groups of 2 and 51 individuals were reported. 5 of the groups were reported to contain a single calf.

The survey report estimated a population of 1,820 ± 380 (standard error) dugong in the main Saudi Arabian Red Sea waters. The report also suggests a Red Sea population of up to 4,000 dugongs. Whether these populations existed in 1987, let alone more recently, requires significant assumptions and should be viewed with some caution.

The Egypt survey reported 30 individuals (Shawky, et. al., 2017).

The 2009 Farasan Bank survey reported two individuals, both at the same location (Al-Mansi, A.M.A., 2016).

The status sheet for Dugong is presented in figure 30 below. Whilst the difference in averages is positive it is based on two different parts of the RSGA, each covering a separate period and using completely different methods. The results should, therefore, be viewed with caution which is why the change is signalled by a “?” and the change is backed in grey.

(103) Djibouti: Article 5, Decree No. 2004-0065 / PR / MHUEAT
(104) Egypt: The Nature Protectorates Law 102/1983 and the Environment Law 4/1994 as amended by Law 9/2009 do not explicitly specify dugong but the implication is that they are protected if they are endangered under international law to which Egypt is a signatory.
(105) Sudan: Marine Fisheries Law, RSS, 2008, amended 2015. However, not in national legislation.
(106) Yemen: By implication. Article 52 (d) of Law 2/2006 specifies sea mammals but not dugong explicitly.
(107) The dugong 2017 national report for Saudi Arabia indicates that legal measures are in place (answer to question 15). https://www.cms.int/sites/default/files/document/cms-dugong_mos3_inf12-17_nr-sa.pdf
(108) Somalia: Puntland Fisheries Regulations 2004. Arts.13, & 14; in particular, fishing marine or endangered species or mammals is prohibited, Art 29 (1). The dugong national report for Somalia indicates no legal measures are in place (answer to question 15).

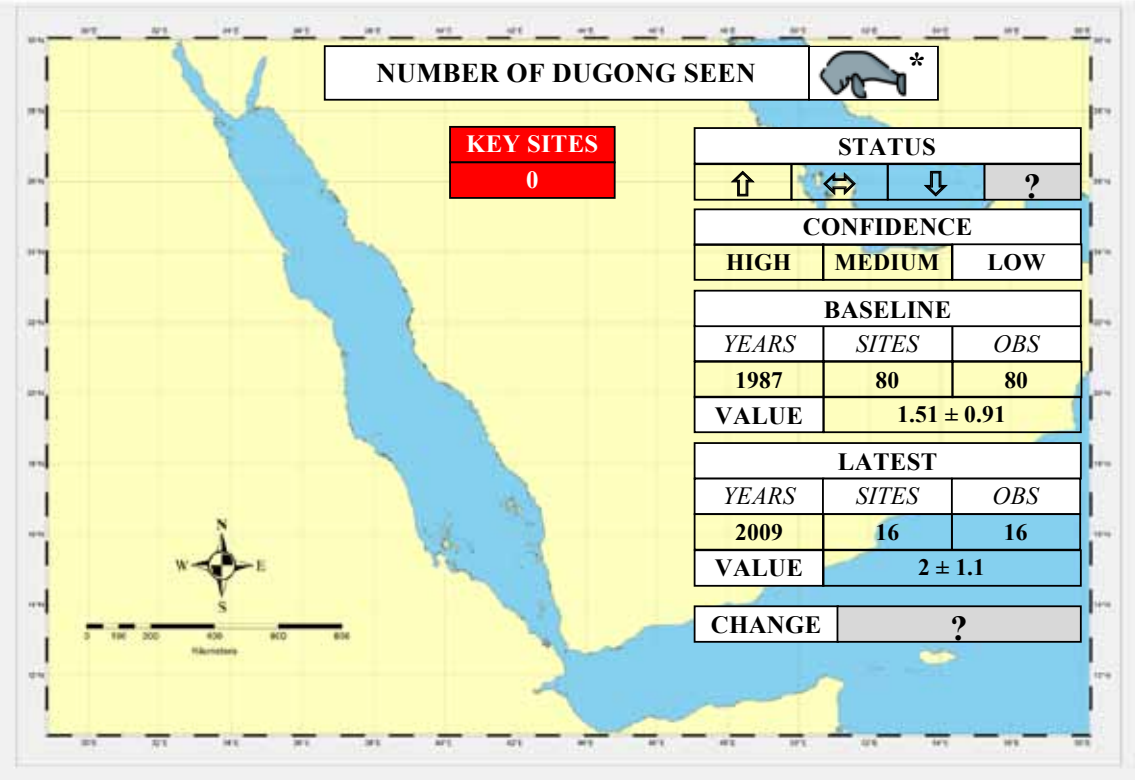


*Figure 30. Status of SOMERSGA indicator – Number of Dugong Seen (OBS = Observations; *icon made by Freepik from www.flaticon.com;)*

Key sites

No key sites have been identified and so are not shown in figure 30.

Recommendations

1. Dugong should be explicitly legally protected in member countries where they are not currently protected and countries where they are protected should formally request that dugong be included in Annexes 1 and 2 of the MPAs Protocol (PERSGA, 2005b) under the Jeddah Convention.
2. There should be more comprehensive and frequent surveys including aerial surveys(109) and tagging to assess the status of dugong in support of SOMERSGA III.
3. Citizen science initiatives such as “Wildbook”, “MAP of Life” tracking app https://mol.org/mobile#/, and Google Earth “Census of Marine Life” http://www.comlmaps.org/census-on-google-earth/ and “Animal tracking” layers should be integrated and mainstreamed to provide a unified public access platform for providing and using monitoring information on the status of dugong.
4. PERSGA should deliver a SOMERSGA III report on the status of dugong and the implementation of recommendations 1-3 by the end of 2025.

(109) Use of drones may provide a cost-effective tool for such aerial surveys.

"Seabirds" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

There is an International Plan of Action (IPOA) for reducing incidental catch of seabirds in longline fisheries (FAO, 1999; FAO, 2009). The status of the IPOA in the RSGA region has not been determined.

"Active osprey nests" were identified as a SOMERSGA II indicator.

Seabirds are a key ecological component of the RSGA depending on marine sources of food and providing opportunities for nature tourism.

PERSGA produced a report on the status of breeding seabirds in the RSGA in 2003 (PERSGA/GEF, 2003). Much of the information from this report was used in the 2006 RSGA SOMER I report in 2006 (PERSGA, 2006). Whilst there have been surveys of seabirds in the RSGA since 2006 (for example Shobrak, M.Y., and Aloufi, A.A., 2014), it has not been possible to source, collate, and standardize this information since then, including for the one seabird indicator identified for SOMERSGA II, namely "Active Osprey Nests" described below. Possible "Seabirds" indicators include: "Key nesting areas", "Key feeding areas", "Key prey species", "Active nests", "Clutch size", "Clutch viability", "POPs in tissues".

Recommendations

Given that only one SOMERSGA II indicator has been specified for "Seabirds" it is recommended, taking note of the above suggestions, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

38.1 Active Osprey Nests

"*Active osprey nests*" are a SOMERSGA II indicator. The indicator was ranked 28th out of 31 for 41 indicators with an environmental weighting of 5.93 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Osprey feed on marine fish and breed and nest in coastal areas. Osprey are large, and charismatic, seabirds and their nests are conspicuous and relatively easy located. Whilst osprey are indicated to be of least concern globally[110] this may not be the case for the RSGA. Osprey are also listed on Appendix II of the CITES and CMS Conventions[111] which all signatories of the Jeddah Convention have ratified.

As indicated above it has not been possible to source, collate and standardize information on "*Active Osprey nests*" in time for SOMERSGA II.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "*Active Osprey Nests",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

(110) https://www.iucnredlist.org/species/22694938/93478747
(111) https://speciesplus.net

"Marine Reptiles" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

"*Marine turtle nesting*" was identified as a SOMERSGA II indicator and is described below. Possible additional "*Marine Reptiles*" indicators include: *"Species", "Key nesting areas", "Key feeding areas", "Clutch size", "Clutch viability", "Egg sex", "Migration patterns", "POPs in tissues".*

Recommendations

Given that only one SOMERSGA II indicator has been specified for "*Marine Reptiles"* it is recommended, taking note of the above suggestions for indicators, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

39.1 Marine turtle nesting

Background

"Marine turtle nesting" is a SOMERSGA II indicator (Fig 31). This indicator was ranked 17th out of 31 for 41 indicators with an environmental weighting of 6.93 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Figure 31: Nesting green turtle, 17th July 2016, Zabargad Island, Egypt. (Credit Islam El-Sadek, EEAA, Red Sea Protectorates).

The two species of marine turtle most commonly found in the RSGA region are the green turtle *Chelonia mydas* and the Hawksbill turtle *Eretmochelys imbricata*. Green turtles are indicated to be endangered and Hawksbill turtle critically endangered on the IUCN Red List(112). Both species are on Appendix I of CITES, and also on appendices I and II of the CMS/Bonn Convention(113). All Jeddah Convention signatories have ratified the CITES and CMS/Bonn Conventions.

Egypt, Jordan, Saudi Arabia, Sudan,and Yemen are signatories to the Indian Ocean and South-East Asia (IOSEA) Marine Turtles MoU(114). Turtle IOSEA National reports have been produced by Egypt, Jordan, Saudi Arabia, and Sudan although a number of these have only been partially completed(115).

No information has been sourced on the migration of turtles in the RSGA. Marine turtles are protected in Djibouti(116), Jordan(117), Saudi Arabia(118), Sudan(119), Egypt(120) and Yemen(121). The legal status of turtles, in Somalia(122), needs to be confirmed.

(112) https://www.iucnredlist.org
(113) https://speciesplus.net. Appendix II of CMS covers migratory species that have an unfavourable conservation status.
(114) https://www.cms.int/en/legalinstrument/iosea-marine-turtles. Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia.
(115) https://www.cms.int/iosea-turtles/en/documents/national-reports
(116) Djibouti: Article 5, Decree No. 2004-0065 / PR / MHUEAT. Hawksbill turtle, loggerhead turtle, green turtle, leatherback turtle.
(117) Jordan: Instructions No (g/5) for the year 2006 for organising fishing in Aqaba. Issued under paragraph (a) of article 55 of the interim Agriculture Law (44) for the year 2002
(118) Saudi Arabia: The CMS turtle MoU 2010 national report for Saudi Arabia response to question 1.5.1 confirms that turtle are legally protected under "Ministerial Decision number 21911 dated on 27/3/1409H equivalent to 6/11/1988G issued by the Minister of Agriculture defining the Executive Bill of the law issued by the Royal Decree number M/9 dated 27/3/1408 H equivalent to 18/11/1987 https://www.cms.int/iosea-turtles/sites/default/files/document/SaudiArabia_19_09_2014.pdf
(119) Sudan: Marine Fisheries Law, RSS, 2008, amended 2015. However, not in national legislation.
(120) Egypt: The Nature Protectorates Law 102/1983 and the Environment Law 4/1994 as amended by Law 9/2009 do not explicitly specify turtle but the implication is that they are protected if they are endangered under international law to which Egypt is a signatory.
(121) Yemen: Article 52 (d) of Law 2/2006
(122) Somalia: Puntland Fisheries Regulations 2004. Arts.13, & 14; in particular, fishing marine or endangered species or mammals is prohibited, Art 29 (1).

Methodology

Grey and published literature was searched to source sightings of turtle nesting with abundance, date and location attributes. Key materials included:

1. the IUCN, PERSGA, MEPA Saudi Red Sea surveys in 1982 to 1983 (IUCN, PERSGA, MEPA, 1984a,b; IUCN, PERSGA, MEPA, 1985a-e) where the middle of an indicated range of number of nests has been taken;
2. surveys of turtle nesting in Egypt, between 2002 and 2008 (Hanafy, M.H., 2012);
3. A turtle review in 2004 in support of the PERSGA Strategic Action Plan (SAP), (Al-Mansi, A.M.A., 2004);
4. Two observations of turtle nesting in Djibouti in 1998 (PERSGA, ALECSO, 2003).

Unfortunately, it has not been possible to obtain any quantitative information for the period 2008-2018 for SOMERSGA II. In addition, a number of anecdotal observations could not be included because they lacked one or more of: a clear geographic location, a date and an indication of number of nests.

Status

The distribution of the nesting sites by source is illustrated in Figure 32 below (see also PERSGA, 2019a, b).

The numbers in white, in figure 32, show the locations of the 5 sites with the largest number of nests per annum reported. Generally speaking, green turtle nest in large rookeries whilst hawksbill turtle nest in small ones.

1. Ras Sharma in the Yemeni Gulf of Aden with 20,037 nests in 2002 (Al-Mansi, A.M., 2004);
2. The Island of Zabargad in Egypt with 1,527 nests in 2008 (Hanafy, M.H., 2012);
3. Jabal/Jazirat Aziz in the Yemeni Gulf of Aden with 500 nests in 1980 (Al-Mansi, A.M., 2004)(123)
4. Ras Alaquqe/Baridi Saudi Arabia with 357 nests in 2002 (Al-Mansi, A.M., 2004);
5. Four sites in the Saudi Arabian Red Sea in 1982 to 1983 with 50-99 nests, one of them (not shown) in the vicinity of Ras Baridi (Site 04) (IUCN, PERSGA, MEPA, 1984a, b; IUCN, PERSGA, MEPA, 1985a-e).

Figure 32. Location of dated and quantified turtle nesting in the PERSGA region. Numbers in white indicate the 5 largest recorded turtle rookeries shown by these data.

Figure 33 below shows a summary of the status of turtles in the PERSGA region

(123) Ross, Barwani 1982 cited in Al-Mansi, A.M., (2004).

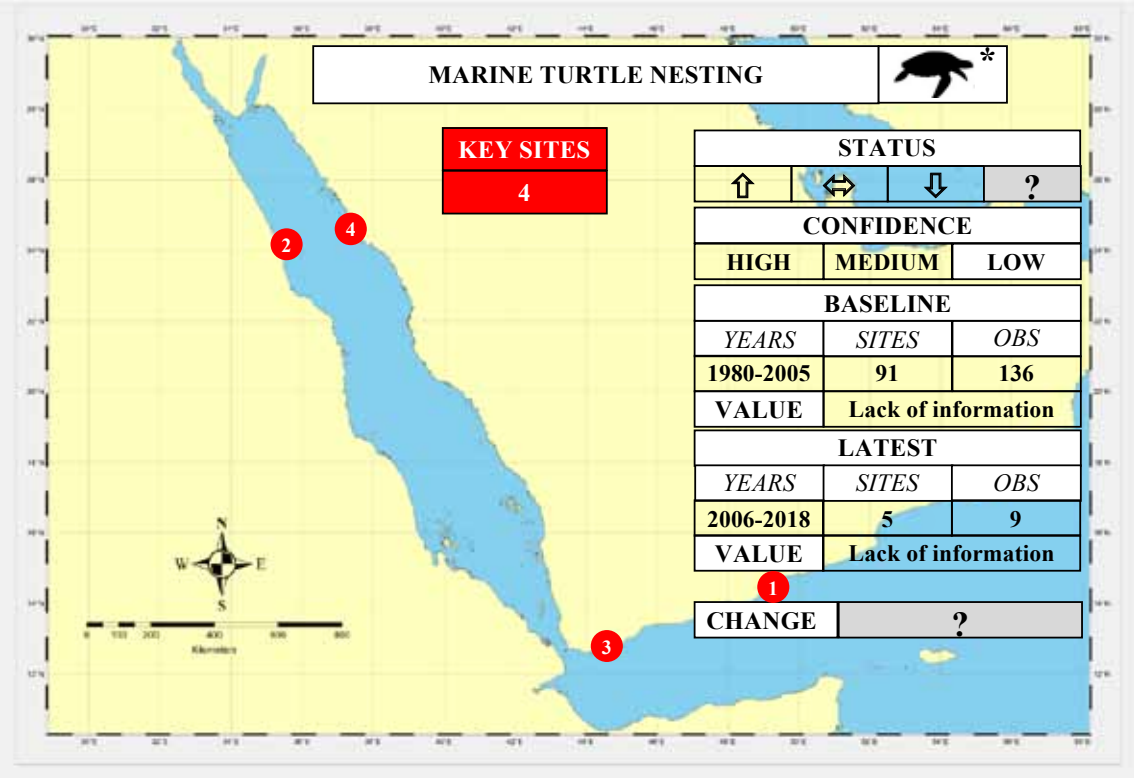


*Figure 33: Status of SOMERSGA indicator – Marine Turtle Nesting (OBS = Observations; *icon made by Freepik from www.flaticon.com;)*

Unfortunately, it is **not** possible to determine a trend in the status of marine turtles within the PERSGA region with any statistical confidence from the information that is available. The change box, therefore, contains a "?" and is highlighted in grey . The reasons for this uncertain status are twofold. Firstly, no information on turtle nesting is available post-2008. Secondly, the distribution of nesting intensity is not a normal statistical distribution but is heavily skewed in favour of a limited number of sites. 14 sites (9.5%) had more than 50 nests per annum. 26 sites (17.7%) had 25-49 nests per annum. 41 sites (27.9%) had 10-24 nests per annum. 66 sites (44.9%) had 1-9 nests per annum.

However, there is some scope for optimism. The total nests at Zabargad Island, in Egypt, do show more nesting in the years 2006 through 2008 than 2001 through 2005 (Hanafy, M.H., 2012)[124].

Key sites

The key sites are shown by number in figure 33 above:

1. Yemen: Ras Sharma in the Gulf of Aden is the largest turtle rookery reported to date in the PERSGA region with 20,037 nests in 2002 (Al-Mansi, A.M., 2004). A newspaper report in 2017 expresses concern about the "slaughter" of turtles.

2. Egypt: The Island of Zabargad is the second largest turtle rookery reported to date in the PERSGA region with 1,527 nests in 2008 (Hanafy, M.H., 2012). The rookery beaches are protected within Elba National Park, and its regional significance should also be recognised.

3. Yemen: Jabal/Jazirat Aziz is the third largest turtle rookery reported to date in the PERSGA region with 500 nests in 1980 (Al-Mansi A.M., 2004). Its current management status is unknown.

(124) 2001 - 438 green turtle nests; 2003 – 512 green turtle nests; 2004 – 675 green turtle nests; 2005 – 718 green turtle nests; 2006 – 1456 green turtle nests; 2007 – 1114 green turtle nests; 2008 – 1527 green turtle nests. Hanafy, M.H., 2012.

4. Saudi Arabia: Ras Alaquqe/Baridi is the fourth largest turtle rookery reported to date in the PERSGA region with 357 nests reported in 2002 (Al-Mansi A.M., 2004). Significant concern was expressed in that time at the level of disturbance including from vehicles driving on the nesting beaches. Its current management status is unknown.

Recommendations

1. Every effort should be made to provide national legal recognition for Ras Sharma and Jabal/Jazirat Aziz in Yemen and Ras Alaquqe/Baridi in Saudi Arabia as regionally significant turtle nesting areas.
2. PERSGA member countries should formally request that turtle be included in Annexes 1 and 2 of the Jeddah Convention MPAs Protocol (PERSGA, 2005b).
3. There should be more replicable, quantitative, and frequent, surveys of nesting numbers, clutch sizes and egg viability, at specified locations and times with which to determine any trend in the status of turtles.
4. Citizen science initiatives such: (i) as "Wildbook", "MAP of Life" tracking app https://mol.org/mobile#/; (ii) Google Earth "Census of Marine Life" http://www.comlmaps.org/census-on-google-earth/ (iii), the Ocean biogeographical information system – spatial ecological analysis of megavertebrate populations (OBIS-SEAMAP) http://seamap.env.duke.edu/swot and; (iv) "Animal tracking" layers should be integrated and mainstreamed to provide a unified public access platform for providing and using monitoring information on the status of turtles.
5. PERSGA should deliver a SOMERSGA III report on the status of turtle and the implementation of recommendations 1-4 above by the end of 2025.

Chapter 40: Sharks and other Elasmobranchs

"Sharks and other elasmobranchs" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

Three indicators for "*Sharks and other elasmobranchs*" were proposed as SOMERSGA II indicators namely: "*Whale shark numbers*", "*Hammerhead aggregation encounters*" and "Manta ray encounters". The status of these three indicators under SOMERSGA II is described below.

Figure 34.Oceanic white tip shark – Red Sea(Credit: HEPCA)

"*Sharks and other elasmobranchs*" are a key ecological component of the RSGA. Sharks are top level carnivores and keystone predators maintaining the trophic structure of coral reef and other marine communities (Fig 34).

Sharks and elasmobranchs are "*charismatic megafauna*". Some, like whale sharks, hammerhead sharks and manta rays, can generate high economic returns, by staying alive, and providing a viewing experience for nature-based tourism. Many species of shark and other elasmobranchs are at high risk from overfishing. Some species, like the whale shark described in sub-chapter 40.1 and the hammerhead sharks in sub-chapter 40.2 are identified as endangered. Certain manta ray described in sub-chapter 40.3 are vulnerable. FAO produced a guide to sharks and rays of the Red Sea and the Gulf of Aden in 2007[125].

(125) ftp://ftp.fao.org/docrep/fao/010/a1502e/a1502e.zip

There is an international plan of action (IPOA) for sharks (FAO, 1999[126]). There is no regional plan of action (RPOA) for sharks in the RSGA region. None of the 7 country signatories to the Jeddah Convention are reported to have a National Plan Of Action (NPOA) for sharks (Fischer, et. al., 2012).

All Jeddah Convention signatories have ratified the CITES and CMS/Bonn Conventions. Both these Conventions are relevant to the conservation of sharks.

Egypt, Jordan, Saudi Arabia, Somalia, Sudan, and Yemen are signatories to the CMS Sharks Memorandum of Understanding (MOU). Djibouti is a range state[127]. CMS Shark MoU National reports have been produced by Saudi Arabia and Yemen.Sharks are generally protected in Djibouti[128], Egypt[129], Jordan[130], Saudi Arabia[131], Sudan[132]. As far as can be determined shark are **not** explicitly protected in Yemen[133] .Their legal status in Somalia[134],needs to be confirmed.

There is no comprehensive review of the status of sharks and other elasmobranchs in the RSGA and there was no opportunity to undertake such a review in support of SOMERSGA II.

Recommendations

Given the limited objective information obtained on the SOMERSGA II "*Sharks and other elasmobranchs*" indicators described below, and the possibility that other "*Sharks and other elasmobranchs*" indicators should be considered, it is recommended, for SOMERSGA III that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

40.1 Whale shark numbers

Background

Figure 35.Whale shark (WS022 Jesse EM Cochran 15/4/2015 at 11:36)

Whale Shark, *Rhincodon typus,* occurrence is a SOMERSGAII indicator.This indicator was ranked 7th out of 31 for 41 indicators with an environmental weighting of 7.87 out of 10 at the Jeddah SOMERSGA II workshop in October 2018. Whale shark are listed as endangered in the IUCN Red List[135], are on appendix II of CITES, and on appendices I and II of the CMS/Bonn Convention[136]. All Jeddah Convention signatories have ratified the CITES and CMS/Bonn Conventions. Egypt, Jordan, Saudi Arabia, Somalia, Sudan, and Yemen are signatories to the CMS Sharks MoU. Djibouti is a range state[137]. CMS Shark MoU National reports have been produced by Saudi Arabia and Yemen.

(126) http://www.fao.org/ipoa-sharks/en/
(127) https://www.cms.int/sharks/en/page/sharks-mou-text
(128) Djibouti: Decree No. 2004-0065 / PR / MHUEAT
(129) Egypt: Sharks decree from the Red Sea Governorate (http://www.hepca.org/conservation/projects/sustainable-fishing). The Nature Protectorates Law 102/1983 and the Environment Law 4/1994 as amended by Law 9/2009 indicate that shark species are protected if they are endangered under international law to which Egypt is a signatory.
(130) Jordan: All sharks are protected against exploitation. Instructions No (g/5) for the year 2006 for organising fishing in Aqaba. Issued under paragraph (a) of article 55 of the interim Agriculture Law (44) for the year 2002.
(131) Saudi Arabia: Under a royal decree from 2008 (Letter no: 57543 dated: 23/8/1429) all shark-fishing activities in Saudi Arabia are illegal (https://repository.kaust.edu.sa/bitstream/handle/10754/320296/Julia%20Spaet%20Dissertation.docx.pdf?sequence=2)
(132) Sudan: Marine Fisheries Law, RSS, 2008, amended 2015. However, not in national legislation.
(133) Yemen: To be confirmed: Shark fins can be conditionally fished in Yemen according to Article 19 of Law 35/98
(134) Somalia: Puntland Fisheries Regulations 2004. Arts.13, & 14; in particular, fishing marine or endangered species or mammals is prohibited, Art 29 (1).
(135) https://www.iucnredlist.org
(136) https://speciesplus.net (CMS Appendix I species are endangered, meaning "facing a very high risk of extinction in the wild in the near future)".
(137) https://www.cms.int/en/legalinstrument/iosea-marine-turtles. Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia.

Whale shark are nationally protected in Djibouti[138], Egypt[139], and Sudan[140]. As far as can be determined whale shark are **not** explicitly protected in Jordan[141], and Yemen[142]. Their legal status in Saudi Arabia is not known and, in Somalia[143], needs to be confirmed.

Whale sharks are highly migratory. For example, one whale shark (see figures 35[144] and 36[145]) tagged at Sh'ib Habil in Saudi Arabia travelled to near Shadwan Island off Hurghada in Egypt and halfway back before the tag dropped-off.

Methodology

Djibouti whale shark data were provided courtesy of the Marine Conservation Society Seychelles, in association with the Marine Conservation Society Djibouti, DECAN, Megaptera and the Shark Research Institute.

We would like to thank the KAUST Reef Ecology Lab, particularly ML Berumen, JEM Cochran, and RS Hardenstine for useful discussions regarding whale shark movement ecology in the Red Sea.

Individual whale sharks were identified by tag or pattern during specified observation periods in the western gulf of Tadjoura in Djibouti[146] (general location 11.589949°N, 42.729845°E) and in the vicinity of Shi'b Habil[147] in Saudi Arabia (general location 20.118920°N, 40.222515°E). It is understood that, at least two of the individuals were observed at both sites so numbers are not absolute but can be used to suggest change.

Figure 36. R. Hardenstine, 2018 using ArcGIS with data from ESRI World Oceans base layer, MF Campbell Jr., and whale shark tracks from Berumen et al. 2014.

Whale shark sightings outside these areas were not used as an indicator of the state of the whale shark population because of the limited numbers seen and because such sightings could represent multiple observations of the same individual.

Status

Figure 37 summarises the status of Whale Sharks in the RSGA region.

Many of the whale sharks observed in the Red Sea appear to be sub-adults. It may be that aggregations reflect sub-adult nursery grounds. There is not enough information to determine the current status of whale shark populations in the Red Sea and Gulf of Aden (see figure 37).

(138) Djibouti: Decree No. 2004-0065 / PR / MHUEAT (DID4075) and La plage d'Arta proposed for protection (MHUE, Pers. Comm. Aden Elmi, Conseiller Technique).
(139) Egypt: Sharks decree from the Red Sea Governorate (http://www.hepca.org/conservation/projects/sustainable-fishing). The Nature Protectorates Law 102/1983 and the Environment Law 4/1994 as amended by Law 9/2009 do not explicitly specify whale sharks but the implication is that they are protected if they are endangered under international law to which Egypt is a signatory.
(140) Sudan: Marine Fisheries Law, RSS, 2008, amended 2015. However, not in national legislation.
(141) Jordan: Not explicit but implied since all sharks are protected against exploitation. Instructions No (g/5) for the year 2006 for organising fishing in Aqaba. Issued under paragraph (a) of article 55 of the interim Agriculture Law (44) for the year 2002.
(142) Yemen: To be confirmed: Shark fins can be conditionally fished in Yemen according to Article 19 of Law 35/98.
(143) Somalia: Puntland Fisheries Regulations 2004. Arts.13, & 14; in particular, fishing marine or endangered species or mammals is prohibited, Art 29 (1).
(144) 15/4/2015 at 11:36 sheltered side of Shib Habil, Al Lith (N 20 07.335 E 40 13.762)
(145) Whale shark WS022. Map created by R. Hardenstine using ArcGIS with data from ESRI World Oceans base layer, MF Campbell Jr., and whale shark tracks from Berumen et al. 2014. WS 022 (R-020) is an approximately 5.5m Female tagged on April 15, 2010 her tag number is 52537. She was only seen the date that she was tagged in Al Lith, according to our sighting records. However, through Wildbook we have found a confirmed sighting of her in Ras Mohammed National Park, Egypt on August 14, 2009.
(146) Rowat, D., 2018, pers. comm, david@mcss.sc. Observations from 2003 to 2017, no surveys in 2005 and 2008
(147) Cochran JEM, et. al., (2016), Hardenstine, R., 2018 pers. Comm. Observations from 2010 to 2018.

However, the number of whale shark seen in the Shi'b Habil region has fallen to the low single figures in 2016-2017 and is a concern.

Key sites

Two key sites for whale shark in the PERSGA region are illustrated in figure 37.

1. The western Gulf of Tadjoura, in Djibouti, which has been identified as a whale shark aggregation area since 2003.
2. Shi'b Habil in Saudi Arabia which has been identified as a whale shark aggregation area since 2010.

There are other occasional whale shark sightings recorded throughout the PERSGA region.

Recommendations

1. Whale sharks should be legally protected(148) in member countries where they are not currently protected, and countries where they are protected should formally request that whale shark be included in Annexes 1 and 2 of the MPAs Protocol (PERSGA, 2005b) under the Jeddah Convention.
2. The tagging and pattern recognition initiatives in the Tadjoura area of Djibouti and the Shi'b Habil area of Saudi Arabia should be continued, and expanded, to increase understanding of the status of whale sharks.
3. Citizen science initiatives such as the "Wildbook for Whalesharks" https://www.whaleshark.org/, "MAP of Life" tracking app https://mol.org/mobile#/, and Google Earth "Census of Marine Life" http://www.comlmaps.org/census-on-google-earth/ and "Animal tracking" layers should be integrated and mainstreamed to provide a unified public access platform for providing and using monitoring information on the status of whale shark.
4. PERSGA should deliver a SOMERSGA III report on the status of whale shark and the implementation of recommendations 1-3 above by the end of 2025.

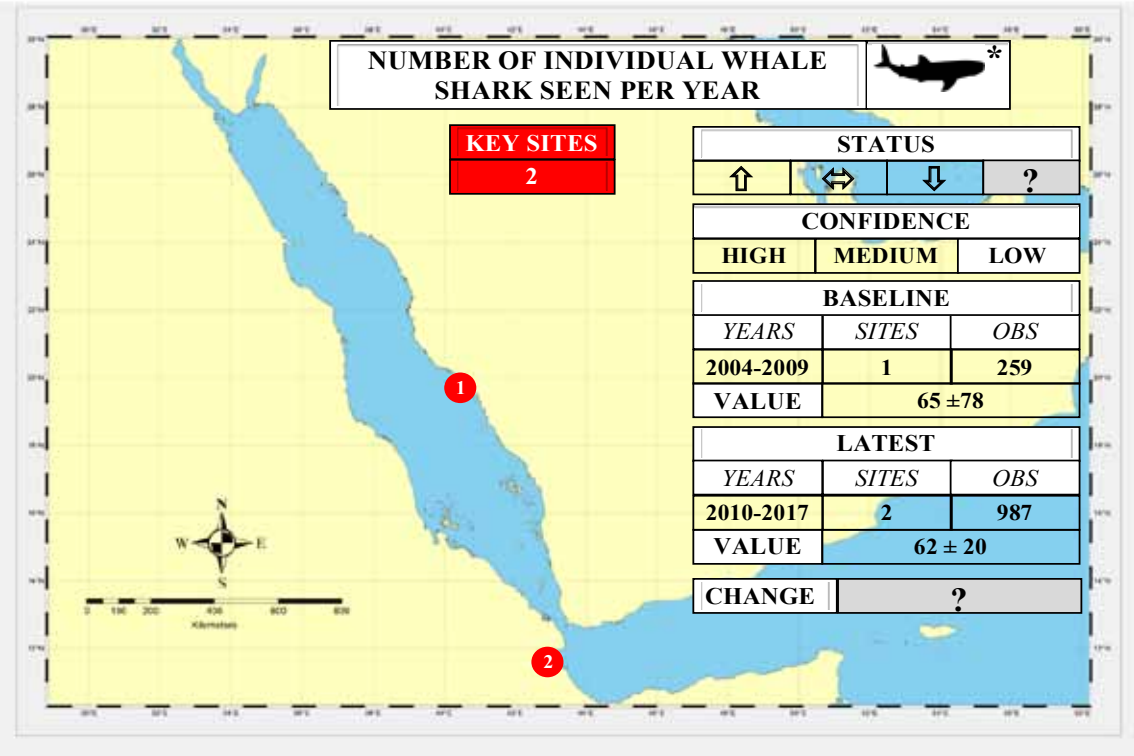


*Figure 37: Status of SOMERSGA indicator –Number of Individual Whale Shark Seen Per Year (OBS = Observations; *icon made by Freepik from www.flaticon.com;)*

(148) All PERSGA countries, except Somalia, have ratified the CMS/Bonn Convention on migratory species.

40.2 Hammerhead aggregation encounters

"*Hammerhead aggregation encounters*" *is a SOMERSGA II indicator. This indicator was ranked 18th out of 31 for 41 indicators with an environmental weighting of 6.87 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.*

Hammerhead shark are "*charismatic megafauna*" that can generate high economic returns from nature-based tourism particularly in known aggregation locations.

Hammerhead sharks are under significant fishing pressure. The scalloped hammerhead [149] and great hammerhead[150] are considered to be endangered. The scalloped hammerhead and great hammerhead are also listed on Appendix II of the CITES and CMS conventions[151] which all signatories of the Jeddah Convention have ratified.

Unfortunately, it has not been possible to source, collate, and standardize information on «Hammerhead aggregation encounters» in time for SOMERSGA II.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "*Hammerhead aggregation encounters",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

40.3 Manta ray encounters

"Manta ray encounters" is a SOMERSGA II indicator. This indicator was ranked 19th out of 31 for 41 indicators with an environmental weighting of 6.8. out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Manta ray are "charismatic megafauna" that can generate high economic returns from nature-based tourism particularly in known aggregation locations.

Manta ray are plankton feeders and so do not take bait on a line. They are an occasional bycatch as a result of entangling in nets. As far as is known they are not targeted in any fishery in the RSGA.

The giant manta ray[152] and the reef manta ray[153] are considered to be vulnerable. The giant manta ray and reef manta ray are also listed on Appendix II of the CITES and Appendix I and II of the CMS conventions [154] which all signatories of the Jeddah Convention have ratified.

Unfortunately, it has not been possible to source, collate and standardize information on "*Manta ray encounters"* in time for SOMERSGA II. Initial investigations indicate that, although there have been recent studies in Saudi Arabia (Braun et. al., 2015), and Sudan (Kessel et. al., 2017), available information is relatively limited in the RSGA region[155].

Recommendations

Given the limited information for SOMERSGA II on SOMERSGA II indicator "*Manta ray encounters",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

(149) https://www.iucnredlist.org/species/39385/10190088
(150) https://www.iucnredlist.org/species/39386/10191938
(151) https://speciesplus.net
(152) https://www.iucnredlist.org/species/198921/126669349
(153) https://www.iucnredlist.org/species/195459/126665723
(154) https://speciesplus.net
(155) http://iobis.org/ and https://www.wildme.org/ including https://www.mantamatcher.org/

Chapter 41: Tuna and Billfishes

"Tuna and Billfishes" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

No SOMERSGA II indicators have been proposed for "*Tuna and Billfishes*".

Tuna and billfishes and various Clupeids form a potentially significant part of the catch in the Gulf of Aden, although access is currently restricted by the security situation. These open water (pelagic species) also extend into the southern Red Sea and become increasingly rare moving north. Reef associated species are more commonly targeted in the central and northern Red Sea. An exception is the Gulf of Aqaba where there is a seasonal catch of billfish in deep water.

Unfortunately, it has not been possible to source, collate, and standardize information on "Tuna and Billfishes" in time for SOMERSGA II.

Recommendations

Given the absence of SOMERSGA II indicators for "*Tuna and Billfishes",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 41a: Other bony fishes

"Other bony fishes" is <u>not</u> a chapter title under the World Ocean Assessment (WOA) Regular Process but is considered to be necessary for SOMERSGA II (UNGA, 2016).

It is reported (Bogorodsky and Randall, 2019), that 14.7% (19.3% when combined with the Gulf of Aden) of fish species in the Red Sea are endemic (only found there). Desert-like conditions in much of the RSGA result in clear waters and generally cloudless skies and emphasize and contrast with the vibrancy and color of the fish found on its shallow-water coral reefs.

Four indicators for "Other bony fishes" are specified as SOMERSGA II indicators namely: "*Grouper, numbers"* and "*Napoleon wrasse numbers*", particularly in respect of spawning aggregations, "*Butterflyfish numbers*" and "*Clownfish numbers*".

Unfortunately, it has not been possible to obtain substantial information on these indicators for SOMERSGA II.

Recommendations

Given the limited information obtained for the four SOMERSGA II indicators for *"Other bony fishes" listed above, and the possibility that other indicators for "Other bony fishes" should be identified,* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

41a.1 Grouper numbers

"*Grouper numbers*" are a SOMERSGA II indicator. This indicator was ranked 9th out of 31 for 41 indicators with an environmental weighting of 7.64 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Grouper are "*charismatic megafauna*" that can generate high economic returns from nature-based tourism.

Grouper are prized as a food fish and are also particularly vulnerable to fishing since they migrate and then aggregate to spawn. The fishing of grouper spawning aggregations can deplete the stock of groupers over 10's of kilometers.

Whilst most groupers are considered to be of least concern in respect of threats to their survival, at least one, *Plectropomus marisrubi*, found in the RSGA, is considered to be vulnerable[156].

As far as can be determined no groupers found in the RSGA region are listed under the CITES or CMS conventions[157]. All signatories of the Jeddah Convention have ratified the CITES and CMS Conventions.

There are opportunities for developing citizen science platforms to obtain information on grouper numbers.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "*Grouper numbers",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

41a.2 Napoleon Wrasse numbers

"Napoleon Wrasse numbers" (humphead wrasse, *Cheilinus undulatus*) is a SOMERSGA II indicator. This indicator was ranked 10th out of 31 for 41 indicators with an environmental weighting of 7.57 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

The Napoleon Wrasse, like the grouper, is a "charismatic megafauna" that can generate high economic returns from nature-based tourism.

Also, like grouper, Napoleon Wrasse are prized as a food fish and are also particularly vulnerable to fishing since they migrate and then aggregate to spawn. The fishing of napoleon wrasse spawning aggregations can deplete the stock of Napoleon Wrasse over 10's of kilometers. Napoleon Wrasse are considered to be endangered[158]. Napoleon Wrasse are listed on Appendix II of the CITES convention but are not listed in the CMS convention[159]. All signatories of the Jeddah Convention have ratified the CITES and CMS Conventions.

There are opportunities for developing citizen science platforms to obtain information on Napoleon Wrasse numbers.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "Napoleon Wrasse numbers", it is recommended, in preparation for SOMERSGA III, that the "key recommendations" process presented in Part I is followed to identify this information.

41a.3 Butterflyfish numbers

"*Butterflyfish numbers*" are a SOMERSGA II indicator. This indicator was ranked 23rd out of 31 for 41 indicators with an environmental weighting of 6.5 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Butterflyfish are charismatic components of coral reef fauna and contribute to the attractiveness of coral reefs for nature-based tourism. Butterflyfish are also a significant component of the saltwater aquarium fish trade. Several butterflyfish are endemic to (only found in) the RSGA (Bogorodsky and Randall, 2019). Some butterflyfish depend on coral for food and their presence can be indicative of a healthy reef.

(156) https://www.iucnredlist.org/species/118360372/118360410. It should be noted that it needs to be confirmed whether, or not, this is a sub-species of Plectropomus pessuliferus which is considered to be globally of least concern.
(157) https://speciesplus.net
(158) https://www.iucnredlist.org/species/4592/11023949
(159) https://speciesplus.net

The majority of butterflyfish found in the RSGA are considered to be of least concern in respect of threats to their survival. However, *Chaetodon trifascialis*, the chevroned butterflyfish is considered to be near threatened[160].

As far as can be determined no butterflyfish found in the RSGA region are listed under the CITES or CMS conventions[161]. All signatories of the Jeddah Convention have ratified the CITES and CMS Conventions.

There are opportunities for developing citizen science platforms to obtain information on butterflyfish numbers.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "*Butterflyfish numbers",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

41a.4 Clownfish numbers

"*Clownfish*" are a SOMERSGA II indicator. This indicator was ranked 26th out of 31 for 41 indicators with an environmental weighting of 6.3 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Clownfish are charismatic components of coral reef fauna and contribute to the attractiveness of coral reefs for nature-based tourism. One species of clownfish is found in the RSGA, it is *Amphiprion bicinctus*, the Red Sea, or two banded, clownfish. It is not only found in the RSGA region. It is a component of the saltwater aquarium fish trade.

The Red Sea Clownfish is of least concern in respect of risk to its survival[162] . As far as can be determined the Red Sea Clownfish is not listed under the CITES or CMS conventions[163]. All signatories of the Jeddah Convention have ratified the CITES and CMS Conventions.

There are opportunities for developing citizen science platforms to obtain information on clownfish numbers.

Recommendations

Given the lack of information for SOMERSGA II on SOMERSGA II indicator "*Clownfish numbers",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

(160) https://www.iucnredlist.org/species/165712/6098323
(161) https://speciesplus.net
(162) https://www.iucnredlist.org/species/188320/1857510
(163) https://speciesplus.net

II. Marine Ecosystems and Habitats

Chapter 42: Cold-Water Corals

"Cold-Water Corals" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

No SOMERSGA II indicators have been proposed for "*Cold-Water Corals*".

There are no reports of cold-water corals in the Red Sea and Gulf of Aden.

Chapter 43: Tropical and Sub-Tropical Coral Reefs

"Tropical and Sub-Tropical Coral Reefs" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016)

"*Tropical and Sub-Tropical Coral Reefs*" have cultural, coastal protection, fisheries and food production, rock and sand production, recreation and tourism, and biodiversity significance as summarized in the UN World Ocean Assessment Report of 2016 (UNGA, 2016).

Coral reefs are widespread both inshore and on offshore banks in the Red Sea and Gulf of Aden. Much of the shoreline has a narrow reef flat or shallow lagoon fringed, on the seawards edge, by coral reef. Occasional breaks occur in the reef fringe. These breaks were created during geologically wetter periods with lower sea-levels and can also be the locations where occasional flash floods discharge to the sea. Some of these breaks provide access to sheltered anchorages.

The corals in the northern end of the Gulf of Aqaba grow at seasonally low temperatures considered to be at the extreme of global tolerance. In other parts of the Red Sea and Gulf of Aden corals grow at seasonally high temperatures considered to be at the extreme of global tolerance. However, even these high temperatures have been exceeded at certain locations in recent years leading to coral bleaching and death.

Three indicators for "*Tropical and Sub-Tropical Coral Reefs*" are specified as SOMERSGA II indicators namely: "*Live hard coral cover*", "*Area of hard coral planted*" and "*Bleached hard coral cover".* It has only been possible to obtain relatively objective and quantitative information on the first of these indicators "*Live hard coral cover*" in time for SOMERSGA II and even this information base could be improved.

Recommendations

Given the need to obtain further information on "*Live hard coral cover*", to address the lack of information on "*Area of hard coral planted*" and "*Bleached hard coral cover",* and to consider other "*Tropical and Sub-Tropical Coral Reefs*" indicators, it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

43.1 Live Hard Coral Cover

Background

"Live hard coral cover" is a SOMERSGA II indicator (Fig 38). This indicator was ranked 1st out of 31 for 41 indicators with an environmental weighting of 9.2 out of 10 at the Jeddah SOMERSGA II workshop in October 2018. Live hard coral cover is a key indicator of the health of tropical and sub-tropical coral reefs.

The IUCN Red List [164] does not provide a listing of hard coral for the Red Sea and Gulf of Aden. However, 12 species of hard corals are listed as endangered and 172 as vulnerable in the eastern Indian Ocean.

Hard corals including blue, stony, organ pipe and fire corals are listed under Appendix II of CITES[165] . All signatories of the Jeddah Convention have ratified the CITES convention.

Figure 38. High hard coral cover at Wadi El-Gemal, Egypt Red Sea 24th April 2018. (Credit: Maher Amer)

Hard coral collecting is not allowed in Djibouti[166], Egypt[167], Jordan[168], Sudan[169], Saudi Arabia[170], and Yemen[171]. The legal status of hard coral in Somalia[172] is unclear. Hard corals have evolved in very stable environmental conditions and are, consequently, highly vulnerable to pollution from coastal development and the elevated sea water temperatures and ocean acidification resulting from climate change.

Methodology

Geographically located, dated, and attributable, observations of percent live hard coral cover were sourced for the Red Sea and Gulf of Aden region (PERSGA, 2019a, b). The location of sampling sites used in the analysis is presented in figure 39 below. The observations were then separated into a baseline period before 2006, when the last RSGA SOMER report was produced, and an update period from 2006 to 2018.

The average percent coverage for each period was then compared to give the standard error of the difference between independent means. The current status is presented in figure 40 below.

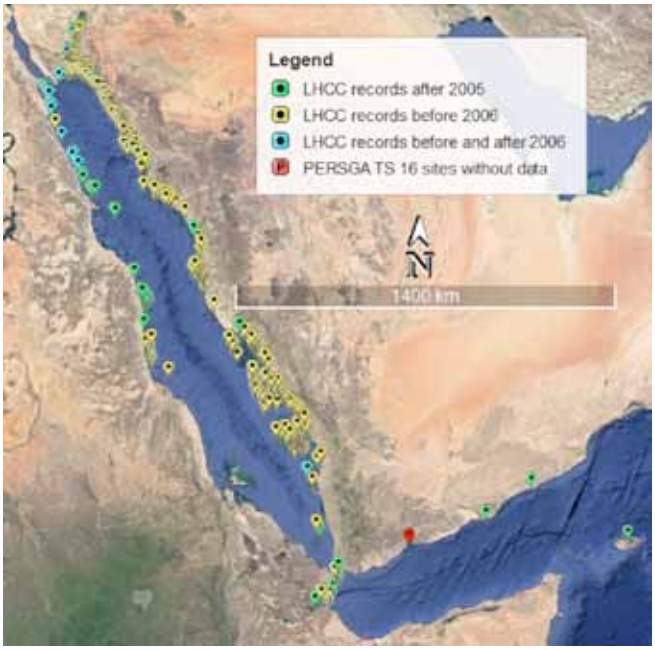


Figure 39. Location of live hard coral cover sampling sites used in the SOMERSGA II analysis.

Status

The analysis shows an overall increase in coral cover of 7.72% ± 1.26 from an average 37.55% (median 35.77%) over the baseline period (1982 to 2005) to 45.32% (median 43.75%) for the follow-up period (2006 to 2018). The baseline period uses 722 records at 503 sites. The follow-up period uses 483 records at 106 sites. It should be noted that many of the follow-up sites are from the northern Red Sea and in the southern Red Sea in the waters of Djibouti.

(164) www.iucnredlist.org
(165) www.cites.org/eng/app/appendices.php. Appendix II lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled.
(166) Djibouti: Law 2004/65, Article 8
(167) Egypt: Law 102/1983, Article 2
(168) Jordan: Instructions No (g/5) for the year 2006 for organising fishing in Aqaba. Issued under paragraph (a) of article 55 of the interim Agriculture Law (44) for the year 2002.
(169) Sudan: The Sudan Marine Fisheries Law of 1937 (amended 1975) requires a permit for coral collecting. Red Sea State Marine Fisheries Law, RSS, 2008, amended 2015 prohibits the collection of coral.
(170) Saudi Arabia: Article 62 of 21911. Permission from Ministry of Agriculture only for scientific purposes.
(171) Yemen: Law 2006/2 Article 52(c) not possible to "c- To uproot, cut or destroy sea weeds or coral reef of different types and species"
(172) Somalia, Puntland… Fisheries regulations Article 29(3) "collecting shells, or damaging coral reefs and mangroves is not prohibited if the ministry grants written permission."

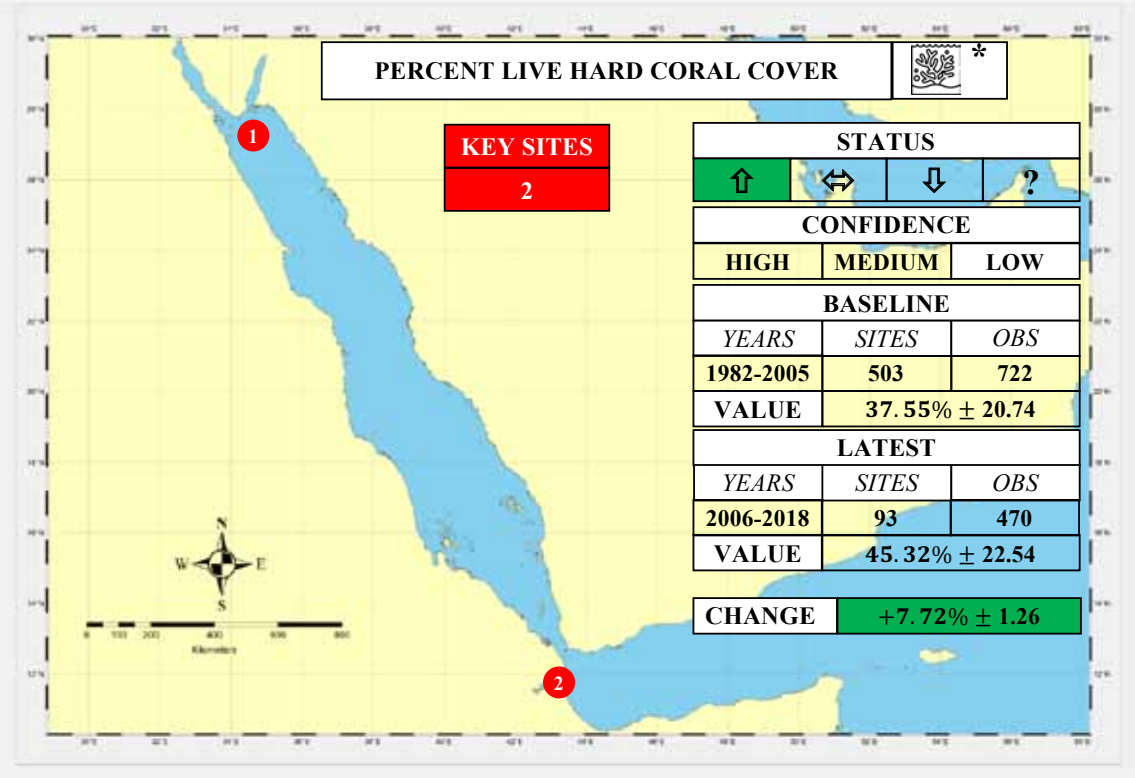


*Figure 40: Status of SOMERSGA indicator – Live Hard Coral Percent Cover (OBS = Observations; *icon made by Freepik from www.flaticon.com;)*

Discussion

Live hard coral cover is highly variable often over the 1 to 10-meter scale reducing the confidence obtained if information is collected using different methods. Observers may also focus on monitoring the "best" areas with higher living hard coral cover than the norm.

A recent assessment in the Pacific shows that live hard coral percent cover has remained relatively stable over the last two decades at close to 25% (Moritz C., et. al., 2018). However, the improving trend in the Red Sea determined above is unexpected given the published (Monroe A.A., et. al., 2018; Bruckner, A.W., and Dempsey, A.C., 2015; Furby, K.A., Bouwmeester, J., and Berumen, M.L., 2013; PERSGA, 2010; Klaus, R., et. al., 2008; Turak, E., et. al., 2007; PERSGA, 2006; DeVantier, L.M., et.al., 2004; Rouphael, A.B., and Al-Yami, H., 2000; and anecdotal evidence (Hefny, W.A., 2015)[173] of deterioration primarily due to coral bleaching.

The last RSGA SOMER report (PERSGA, 2006) states "*One-third of coral reefs in the region were destroyed or impacted by coral bleaching in 1998. Impacts were most intense in the central-northern Red Sea of Saudi Arabia (especially near Rabigh) and in Yemen (Belhaf, Hadhramaut, Socotra Archipelago). Most reefs are recovering*".

It is suggested, by the authors of SOMERSGA II, that the, apparent, improvement of live hard coral cover indicated by the SOMERSGA II data may, in part, be a reflection of the relatively large number of post 2005 observations from the northern Red Sea, where one paper suggests that there has been less coral bleaching than further south (Osman E.O. et. al., 2018) and from the waters of Djibouti in the far south (Cowburn, B., et. al., 2019).

Key sites

Two general areas in the RSGA region are proposed as key sites in figure 40 above.

1. The general northern coral reefs of the Red Sea could be viewed as a key site if they are providing a haven of reduced coral bleaching (Osman E.O. et. al., 2018), although some bleaching has been reported.

(173) Hefny W.,October 2015, (personal communication)

2. The reefs of Djibouti which had high levels of living hard coral cover reported as recently as 2016 (Cowburn, B., et. al., 2019).

However, even if the bleaching is currently limited in the short to medium term in these areas, it may not be so when marine waters warm up further under continuing climate change (UNEP, 2020).

Recommendations

1. The PERSGA coral reef monitoring sites (PERSGA, 2010) should form the core of future SOMERSGA and comprise belt transects between permanently fixed points at equal depth (Isobaths) to maximise comparability.
2. There should be sufficient coral reef monitoring sites within and, outside biodiversity, protected areas to determine the management effectiveness of coastal and marine biodiversity protected areas.
3. Monitoring should include a photographic record to act as reference for further analysis.
4. Citizen science initiatives such as the "MAP of Life" tracking app https://mol.org/mobile # /, and Google Earth "Census of Marine Life" http://www.comlmaps.org/census-on-google-earth/ should be integrated and mainstreamed to provide a unified public access platform for providing and using monitoring information on living hard coral cover.
5. PERSGA members should formally request that living hard corals be included in Annexes 1 and 2 of the MPAs Protocol (PERSGA, 2005b) under the Jeddah Convention.
6. PERSGA should deliver a SOMERSGA III report to include: as data rich a pre-2018 baseline as possible of percent live coral cover, an assessment of the change in percent live hard coral against this baseline between 2018 and 2025, and the implementation of recommendations 1 through 5 by the end of 2025.

43.2 Area of hard coral planted

"*Area of hard coral planted*" is a SOMERSGA II indicator. This indicator was ranked 25th out of 31 for 41 indicators with an environmental weighting of 6.36. out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

"*Area of hard coral planted"* may comprise restoration of areas of hard coral that may, for example, have bleached. "*Area of hard coral planted*" may also comprise the transplanting of hard coral from areas that are likely to be damaged by development. The incidence of restoration and transplanting not only signals efforts at management but also provides a record against which to subsequently monitor the effectiveness of such measures.

Unfortunately, it has not been possible to source, collate and standardize information on "*Area of hard coral planted*" in the RSGA. Information is available, for example for transplanting of hard coral from the container port extension in Aqaba to the nearby Aqaba Marine Park in Jordan(174) and in Yemen(175). The longer-term outcome of these activities is not known.

Recommendations

Given the limited information for SOMERSGA II on SOMERSGA II indicator "*Area of hard coral planted",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

(174) https://www.act.com.jo/content/corporate-social-responsibility-csr
(175) https://pdfs.semanticscholar.org/3c88/b255e361b1021502a83420626719e96704d9.pdf

43.3 Bleached hard coral cover

"*Bleached hard coral cover*" is a SOMERSGA II indicator. This indicator was ranked 11th out of 31 for 41 indicators with an environmental weighting of 7.4 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Bleaching is a widespread and increasingly frequent phenomenon primarily in hard corals and other animals hosting symbiotic algae called zooxanthellae. The colored algae are expelled predominantly, as a stress reaction during periods of elevated seawater temperature. If the period of elevated seawater temperature is too long, then the corals die.

Information on bleached hard coral cover helps justify advocacy for efforts to limit climate change. Information on bleached hard coral cover also helps determine those areas and species that may be less susceptible to bleaching and so more worthy of conservation.

The first RSGA SOMER (PERSGA, 2006) reports that "*One-third of coral reefs in the region were destroyed or impacted by coral bleaching in 1998. Impacts were most intense in the central-northern Red Sea of Saudi Arabia (especially near Rabigh) and in Yemen (Belhaf, Hadhramaut, Socotra Archipelago)".* It should be noted that the 2006 report added that "*Most reefs are recovering".*

Bleaching events have been reported since then including in Saudi Arabia in 2010, and in 2015/2016 (Monroe, A.A., et. Al., 2018). However, it is evident, that not all areas in the RSGA have been equally affected with only very limited recent reports of bleaching from Aqaba, Jordan (2017), the Egyptian Red Sea (2017) and from Djibouti in the southern Red Sea (2016). The factors influencing the distribution of bleaching in the RSGA are clearly complex. However, bleaching is likely to become more frequent and intense as seawater temperatures rise through global warming. Of course, if there is nothing to bleach there will eventually be no reporting of bleaching.

NOAA (https://coralreefwatch.noaa.gov/) issued level 2 bleaching alerts (the highest alert level where significant bleaching and mortality are likely) for the Gulf of Aqaba and Egyptian Red Sea in late August/early September 2020. This level of alert has been issued previously in certain years without any reported bleaching. A request by PERSGA to coral reef practitioners in Egypt in early September indicates that no bleaching has been reported as of 11th September 2020.

Recommendations

Given the limited information for SOMERSGA II on SOMERSGA II indicator "*Bleached hard coral cover",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

Chapter 44: Estuaries and deltas

"Estuaries and deltas" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

In the Red Sea estuaries and deltas often take the form of sharms, marsas or khawrs (coastal inlets) associated with wadihs (relict river courses) and breaks in the coastal fringing reef. These breaks were created during geologically wetter periods with lower sea-levels and can also be the locations where occasional flash floods still discharge to the sea. Some of these gaps provide access to sheltered anchorages. The drier weather, since the last ice-age, together with a relatively low tidal range, and proximity to deep water, limit the development of estuaries and deltas.

There are no perennial (year round flowing) rivers entering the RSGA region. The Barka river flows seasonally into the Tokar delta and from there into the Red Sea in southern Sudan. There are occasional flash floods discharging to the sea and limited locations where there is continuous groundwater seepage to the sea.

No SOMERSGA II indicators have been proposed for "*Estuaries and deltas*".

Recommendations

Given the lack of SOMERSGA II indicators for "*Estuaries and deltas",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 45: Hydrothermal Vents and Cold Seeps

"Hydrothermal Vents and Cold Seeps" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

The Red Sea is a new ocean with a spreading continental margin. Hydrothermal vents are inferred at a number of locations in the Red Sea and confirmed at, at least one location, in the Gulf of Aden region[176] . No cold seeps are reported from the RSGA region[177].

No SOMERSGA II indicators are proposed for "*Hydrothermal Vents and Cold Seeps*".

Recommendations

Given the lack of SOMERSGA II indicators for "*Hydrothermal Vents and Cold Seeps",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 46:High-Latitude Ice & the Biodiversity Dependent on it.

"High-Latitude Ice and the Biodiversity Dependent on it" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

The Red Sea and Gulf of Aden is low latitude and sub-tropical and so does not support high-latitude ice and the biodiversity dependent on it. No SOMERSGA II indicator is proposed for this chapter.

Chapter 47: Kelp forests and seagrass beds

"Kelp forests and seagrass beds" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

Macroalgae (the tropical sub-tropical equivalent of kelp forests) are found on hard substrates with increasing occurrence on moving southwards down the Red Sea. Hard corals may be replaced by macroalgae if hard corals continue to deteriorate. In the Gulf of Aden there are transient kelp forests during the upwelling season of the Somali current.

Seagrass beds are extensive in certain locations in the Red Sea and Gulf of Aden extending from

(176) https://www.un.org/Depts/los/global_reporting/WOA_RPROC/Chapter_45.pdf see also https://vents-data.interridge.org/
(177) https://www.researchgate.net/publication/51560035_Deep-Water_Chemosynthetic_Ecosystem_Research_during_the_Census_of_Marine_Life_Decade_and_Beyond_A_Proposed_Deep-Ocean_Road_Map/download

the immediate subtidal to 50m or more depth. In some locations extensive seagrass meadows provide food for dugong (Chapter 37) and green turtles (Chapter 39). Seagrass habitat is at risk from coastal development, user damage and pollution.

"*Macroalgae*" and "*Seagrass beds*" were not identified as SOMERSGA II indicators due to the lack of readily available information in the SOMERSGA II data format. However, they represent environmentally significant habitats and species.

Recommendations

Given the lack of SOMERSGA II indicators for "*Macroalgae*" and "*Seagrass beds*" it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 48: Mangroves

"Mangrove" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016). Mangrove are salt tolerant perennial shrubs and trees whose root systems are regularly immersed in seawater.

Limited tidal range of around 0.5m, slight seasonal variation in mean sea-level of around 0.5m, and low freshwater input limit the opportunity for development of mangroves in the Red Sea and Gulf of Aden.

Mangroves, in the RSGA region, have traditionally been used for fuel, fodder and construction. High population growth in the coastal zone, and urbanization over the last 30 years, have put pressure on the original mangrove stands.

A review of the status of mangroves in the RSGA was produced by PERSGA in 2004 (PERSGA/GEF, 2004).

Four species of mangrove are reported from the Red Sea and Gulf of Aden. The most widespread is *Avicennia marina*. *Rhizophora mucronata* is found in a few small dense stands in locations where the geomorphology encourages more vigorous tidal water exchange. *Ceriops tagal* has been reported, historically, from restricted locations in Eritrea and Djibouti. *Bruguiera gymnorhiza* has been reported, historically, from Djibouti. However, the presence of *Ceriops tagal* and *Bruguiera gymnorhiza has not been recently re-confirmed.*

All four species are identified globally as of least concern[178] . None of the species is listed on any of the Appendices of CITES[179]. All signatories of the Jeddah Convention have ratified the CITES Convention.

Mangrove are not found in Jordan. Mangrove is protected in Djibouti (seasonal pruning allowed[180]) , Egypt (within protected areas[181]), Sudan[182], Saudi Arabia[183] , and Yemen[184]. The legal status of mangrove in Somalia is unclear[185].

(178) https://www.iucnredlist.org
(179) https://speciesplus.net
(180) Djibouti: Article 10 of Décret no 2004-0065/PR/MHUEAT specifies that "It is forbidden to cut down all trees, including mangroves, over the whole of the Republic of Djibouti, without prior written authorization…." Article 14 specifies that "The pruning of mangroves is allowed to feed only during the dry season which runs from June 1 to September 30".
(181) Egypt: Law 102/1983, Article 2 within protectorates. Status outside not known but most mangrove are within protectorates.
(182) Sudan: Red Sea State Marine Fisheries Law, RSS, 2008, amended 2015 protects mangrove. Status with respect to Federal (national) legislation is not known.
(183) Saudi Arabia: Article 64 of 21911. Permission from MoA only for scientific purposes
(184) Yemen: Law No. 72 of 2010 concerning the National Plan for the Integrated Coastal Zone Management in the Republic of Yemen banning mangrove use throughout the Yemen
(185) Somalia, Puntland… Fisheries regulations Article 29(3) "collecting shells, or damaging coral reefs and mangroves is not prohibited if the ministry grants written permission."

Two SOMERSGA II indicators are identified under the "*Mangrove*" chapter namely "*Area of mangrove"* and "*Area of mangrove planted*".

Recommendations

Unfortunately, it has not been possible to provide a particularly objective and quantitative assessment of the status of the two SOMERSGA II "*mangrove*" indicators "*Area of mangrove"* and "*Area of mangrove planted*" for SOMERSGA II. In addition, it may be appropriate to have other "*Mangrove*" indicators for SOMERSGA III. It is, therefore, recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

48.1 Area of Mangrove

"*Area of Mangrove*" is a SOMERSGA II indicator. This indicator was ranked 03rd out of 31 for 41 indicators with an environmental weighting of 8.8 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

Method

A comprehensive assessment of the status of mangrove in the Red Sea region covered the period from 1972 to 2013 used and satellite imagery and limited localized ground truthing (Almahasheer. H., et. al., 2016).

The study did not cover the Gulf of Aden. As reported by PERSGA (2006), mangrove stands are found in the waters of Djibouti (at Khor Angar, Collines de Gordia, Mousha/Maskali Islands and Djibouti City. They are extremely limited in the Yemeni Gulf of Aden (Bir Ali crater mangrove at 14.025706°N, 48.381234°E, and Socotra, Ghubbah di-Nit).

In the Somali Gulf of Aden, there are several mangrove stands in the vicinity of Seylac near the border with Djibouti for example at 11.423653°N, 43.462440°E, about 100km east of Berbera at 10.818785°N, 45.866831°E, near Abo at 11.835395°N, 50.538475°E, and near Caluula at 11.981495°N, 50.781234° E).

Status

The study concluded "…. that the trend exhibited by Red Sea mangroves departs from the general global decline of mangroves. Along the Red Sea, mangroves expanded by 12% over the 41 years from 1972 to 2013. Losses to Red Sea mangroves, mostly due to coastal development, have been compensated by afforestation projects".

It should be noted that the study indicates that the area of mangrove only increased slightly from 2000 (132 ± 0.5km2) to 2013 (135 ± 0.86km2). However, it is assessed as "unchanged" under the SOMERSGA assessment because of the marginal increase reported by this study and because of unpublished reports of reduction of area of mangrove in certain areas of the RSGA.

Key Sites

Two key sites (areas) are presented in Figure 41:

1. Relates to the coasts of the Red Sea and its islands.
2. Relates to the coasts of the Gulf of Aden and Socotra Island within the Jeddah Convention area.

More objective and quantitative data on the status of mangrove within the Key Site 1 area, and basic data on the status of mangrove within the Key Site 2 area, are required.

Recommendations

Given the lack of independent verification of the survey, particularly in respect of ground truthing, for "*Area of Mangrove*", it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed for "*Area of Mangrove*".

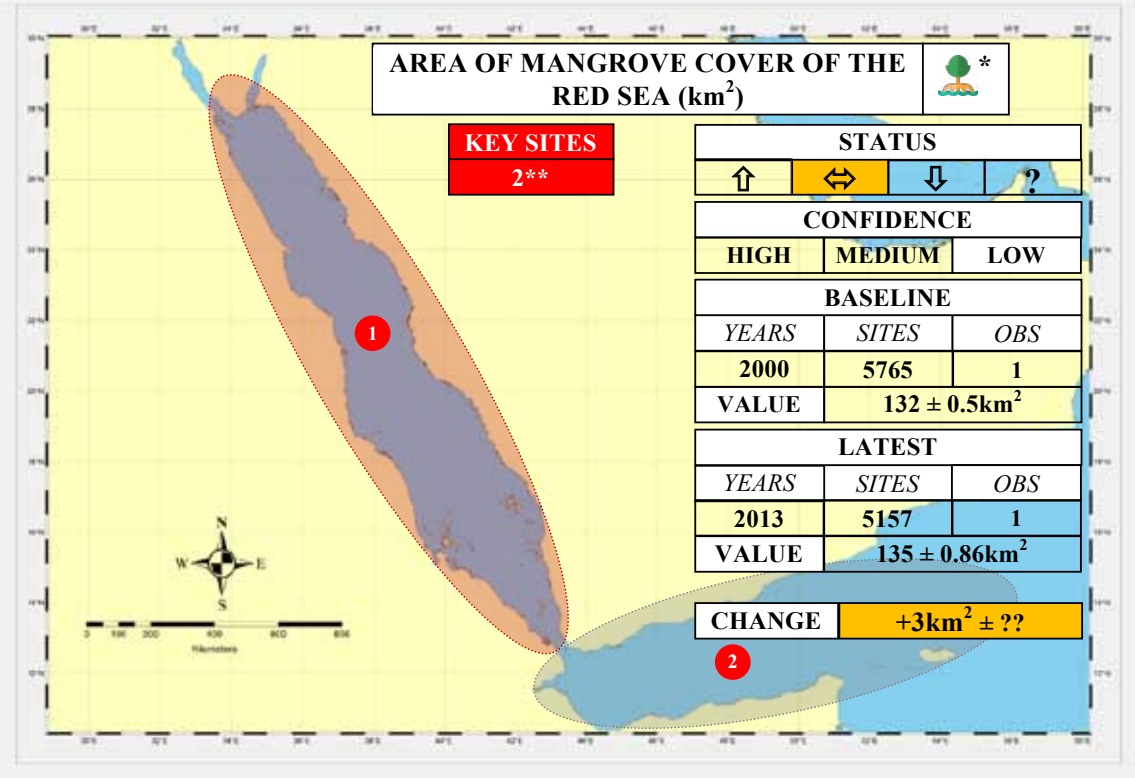


*Figure 41: Status of SOMERSGA indicator – Area of Mangrove Cover (OBS = Observations: *icon made by Freepik from www.flaticon.com;** Site (1) includes coasts the of the Red Sea and its islands; Site (2) includes coasts of the Gulf of Aden and Socotra within the Jeddah Convention area; Information on Site 2 is currently data deficient).*

48.2 Area of Mangrove planted

"*Area of mangrove planted*" is a SOMERSGA II indicator. This indicator was ranked 30th out of 31 for 41 indicators with an environmental weighting of 5.1 out of 10 at the Jeddah SOMERSGA II workshop in October 2018.

"*Area of mangrove planted*" may comprise restoration of areas of mangrove that may, for example, have been damaged by cutting or overgrazing, and the planting, or transplanting of mangrove in areas that may not have formerly had mangrove to compensate for loss of mangrove elsewhere or for other purposes. The incidence of restoration and transplanting not only signals efforts at management but also provides a record against which to subsequently monitor the effectiveness of such measures.

Unfortunately, it has not been possible to source, collate and standardize objective and quantitative information on "*Area of mangrove planted*" in the RSGA. There are references to *Rhizophora mucronata* planting in Saudi Arabia at the Royal Commission in Yanbu[186] and in Djibouti at Khor Angar (see figure 42 above). Information on other planting and restoration initiatives, and the longer-term outcome of the plantings in Yanbu and Khor Angar are not known.

Figure 42. Rhizophora mucronata planting, Khor Angar, Djibouti, 29th March 2013, c. Mohamed Djibril

(186) https://www.rcjy.gov.sa/ar-SA/Yanbu/MediaCenter/DocumentCenter/Documents/Sustainability%20Reporting%20Royal%20Commission%20Yanbu%202014.pdf

Recommendations

Given the limited information for SOMERSGA II on SOMERSGA II indicator "*Area of mangrove planted",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify this information.

Chapter 49: Salt marshes

"Salt marshes" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

Limited tidal range of around 0.5m, slight seasonal variation in mean sea-level of around 0.5m, and low freshwater input limit the opportunity for development of salt marshes in the RSGA. Sabkha (salt flats), with micro-algal veneers, occupy the seasonally inundated areas. Halophytic (salt-tolerant) plants grow on dunes and other areas within, and adjacent to, the sabkhas that are very rarely inundated with seawater. Mangrove (see Chapter 48) occurs in areas subject to regular tidal inundation.

No "*Saltmarshes*" indicator has been specified for SOMERSGA II.

Recommendations

Given the absence of SOMERSGA II indicators for "Saltmarshes", it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Chapter 50: Sargasso Sea

"Sargasso sea" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

The "*Sargasso sea*" is not found in the Red Sea and Gulf of Aden region and no "*Sargasso Sea*" indicators were, therefore, proposed for SOMERSGA II.

Chapter 51: Biological Communities on Seamounts and Other Submarine Features Potentially Threatened by Disturbance.

"Biological Communities on Seamounts and Other Submarine Features Potentially Threatened by Disturbance" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

No significant seamounts are currently reported from the Red Sea and Gulf of Aden. Other Submarine features include deep water reefs such as those found at the northern end of the Gulf of Aqaba. Their status is not well known but these features are likely to be at risk from coastal development and climate change.

Recommendations

Given the absence of SOMERSGA II indicators for *"Biological Communities on Seamounts and Other Submarine Features Potentially Threatened by Disturbance",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification.

Section C – Environmental, economic and/or social aspects of the conservation of marine species and habitats and capacity-building needs.

Chapter 52: Synthesis of Part VI: Marine Biological Diversity and Habitats

"*Synthesis of Part VI: Marine Biological Diversity and Habitats*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

"*Synthesis of Part VI: Marine Biological Diversity and Habitats"* comprises conclusions on the status of the indicators assessed in Part VI "*Assessment of Marine Biological Diversity and Habitats"* presented in Chapters 33 through 51 of this SOMERSGA II report as described above.

The evidence base for Part VI indicators for the SOMERSGA II is relatively limited. Any conclusions that can be drawn are presented in the Summary in Part I and in Chapter 54 of this SOMERSGA II report.

Certain coral reefs have deteriorated due to bleaching, most recently in 2015/2016 resulting from above-normal sea water temperatures most likely due to human induced climate change. Other significant climate change effects are not yet evident but, potentially, include ocean acidification. Ocean acidification has potentially adverse implications for marine ecosystems and the species in these ecosystems that calcify calcium carbonate. These species include hard corals, and certain molluscs, worms, sponges, algae, and plankton.

Any positive trends should not be a basis for complacency: (1) because of the lag between the rapid pace of coastal development and the introduction of effective environmental management and; (2) because negative climate change impacts are projected to be both incremental and of increasing frequency in the coming decades.

Chapter 53: Capacity-Building Needs in Relation to the Status of Species and Habitats

"*Capacity-Building Needs in Relation to the Status of Species and Habitats*" is a chapter title under the UN SOMER World Ocean Assessment regular process to which reference should be made for further information (UNGA, 2016).

This chapter can be considered as linked to/part of Chapter 32 "*Capacity-Building Needs in Relation to Human Activities Affecting the Marine Environment*" to which reference should be made.

Recommendations

This SOMERSGA II report provides a framework and baseline for a set of key RSGA SOMER indicators. "*Capacity-Building Needs in Relation to the Status of Species and Habitats*" should focus on monitoring and reporting on both the status, and the management of any change in status, of these key Species and Habitat indicators identified in this SOMERSGA II Chapters 33 through 51 using the DPSIR[187] model of environmental management.

(187) https://www.eea.europa.eu/publications/92-9167-059-6-sum/page002.html

Part VII OVERALL ASSESSMENT

Chapter 54: Overall Assessment of Human Impacts on the Oceans

"*Overall Assessment of Human Impacts on the Oceans*" is a chapter title under the World Ocean Assessment (WOA) Regular Process to which reference should be made for further information (UNGA, 2016).

The box below presents the overall SOMERSGA II status for those indicators that have been evaluated.

OVERALL SOMERSGA II TREND (2006-2018)	 (188)
The SOMERSGA II score, for those indicators that have been evaluated, shows an overall trend of environmental improvement of 9.55 or approximately 3.25% of the possible total.	

Key issues, in respect of SOMERSGA II reporting, and preparing for SOMERSGA III proposed to be due in 2025, are presented in the box below:

KEY ISSUES	 (189)

1. **Identifying, and agreeing, key indicators for SOMERSGA III including social, economic and environmental indicators of RSGA "Ocean" value to humans.**
2. **Providing objective and quantitative information on key SOMERSGA III indicators**
3. **Climate change (global warming and ocean acidification)**
4. **Urban and tourism development (encroachment, recreational use)**
5. **Reduce, reuse, recycle (pollution, renewable energy, waste management)**
6. **Fisheries governance (Illegal, Unreported and Unregulated fishing - IUU)**
7. **Protected areas governance (protected area management effectiveness - PAME)**

Table 2 provides a summary assessment of the overall status of SOMERSGA II indicators for which there is sufficient information. Sufficient information is not available for a significant number of the proposed indicators and this information will need to be obtained and evaluated for the next SOMERSGA III report proposed to be delivered in 2025.

(188) Icon made by https://www.flaticon.com/authors/gregor-cresnar from www.flaticon.com
(189) Icon made by https://www.flaticon.com/authors/gregor-cresnar from www.flaticon.com

Table 2: Overall SOMERSGA II Status based on available information.

SOMER II INDICATOR	SOMER II SCORE			
	Weight	Rank	Trend	Total
Live hard coral cover (year, site, % cover)	9.2	1	1	**9.2**
Marine biodiversity protected area (year/km^2)*	8.87	2	1	**8.87**
Population of the coastal zone (town/city)	8.8	3	-1	**-8.8**
Marine litter (year/site/occurrence)	8.8	3		
Mangrove (year/site/km^2)	8.8	3	0	**0**
Chlorophyll A values (year/site/value)	8.2	4		
Zero wastewater discharge practice (year/country)	8.13	5		
Oil spills (year/site/tonnes)	8	6	?	?
pH high accuracy (year/site/pH)	7.87	7		
Whale shark (year/site/number)	7.87	7	?	**?**
Wastewater treatment (year/site/m^3)	7.67	8		
Grouper (year/site/number)	7.64	9		
Napoleon wrasse (year/site/number)	7.57	10		
MPA PAME (year/MPA/score)	7.4	11	1	**7.4**
Coral bleaching (year/site/%)	7.4	11		
Dugong (year/site/number)	7.4	11	?	**?**
Ballast water reception (year/site/m^3)	7.33	12		
Marine Fish Landings (year/site/tonnes)	7.27	13	-1	**-7.27**
Ratified multilateral environmental agreements (year/number)	7.2	14	1	**7.2**
Solid waste coastal cleanup (year/site/tonnes)	7.07	15		
Solid waste production (year/site/tonnes)	7	16		
Waste oil reception (year/sites/tonnes)	7	16		
Turtle nests (year/site/number)	6.93	17	?	**?**
Marine aquaculture (year/site/tonnes)	6.93	17		
Hammerhead aggregations (year/site/number)	6.87	18		
POPs in marine fish (year/site/value)	6.8	19		
Certified coastal/marine nature tourism guides (year/site/number)	6.8	19		
Manta ray (year/site/number)	6.8	19		
Red Sea shipping (year/transit-delivery/tonnage)	6.79	20	-1	**-6.79**
Desalination capacity (year/site/m^3)	6.73	21	-1	**-6.73**
Registered dive boats (year/site/number)	6.53	22		
Butterflyfish (year/site/number)	6.5	23		
Blue flag beaches (year/site/number)	6.47	24	1	**6.47**
Managed landfill sites (year/site/tonnage)	6.47	24		
Hard coral planted (year/site/km^2)	6.36	25		
Clownfish (year/site/number)	6.3	26		
EMS accredited Ports (year/site/tonnage)	6	27		
Osprey nests (year/site/number)	5.93	28		
Fisher association membership (year/organisation/number)	5.73	29		
Mangrove planted (year/site/km^2)	5.5	30		
MSC certified wild fisheries (year/fishery)	4.69	31	0	**0**

* "Coastal" areas are not included/defined

Total	293.62	Weight x trend	9.55

Key	improving «+1»	«0» unchanged	«-1» deteriorating	Data deficient ?	Not analysed

The total SOMERSGA II score achieved is obtained by multiplying the environmental significance "**weight**" value by the change "**trend**" value for each indicator and summing for all indicators. The environmental significance "**weight**" was specified for each indicator (maximum 10, minimum 0) by the participants of the SOMERSGA II workshop in Jeddah in October 2018.

The change "**trend**" score ("+1" improving, "0" unchanged and "-1" deteriorating) was determined by the change in indicator value from a baseline year, or group of years, to a more recent year or group of years (see the individual indicator assessments).

Assuming all indicator values were to show a trend of environmental improvement "+1" then the total possible SOMERSGA II environmental improvement score for all indicators would be 293.62.

Chapter 55: Overall Value of the Oceans to Humans

"*Overall Value of the Oceans to Humans*" is a chapter title under the UN SOMER World Ocean Assessment regular process to which reference should be made for further information (UNGA, 2016).

A number of SOMERSGA II indicators relate to value to humans. These include:

However, SOMERSGA II does **not** include indicators that provide direct objective and quantitative information on the actual social, economic and environmental value to humans of RSGA "ocean" services. The SOMERSGA II indicators can only be used to infer value. This deficiency should be addressed by specifying the RSGA "ocean" services and the values that these services deliver in a way that allows them to be directly, objectively and quantifiably verified.

Given the lack of SOMERSGA II indicators for *"Overall Value of the Oceans to Humans",* it is recommended, in preparation for SOMERSGA III, that the "*key recommendations*" process presented in Part I is followed to identify these indicators and their means of objective and quantitative verification. It is further recommended that the services and values comprise **primary** data assessed at the level of the **individual**.

Al-Mansi, A.M.A., (2004). Regional Status of Marine Turtle in the Red Sea and Gulf of Aden. Document 9. Habitats and Biodiversity Conservation Component (HBC). Strategic Action Programme for the Red Sea and Gulf of Aden (SAP). PERSGA.

Al-Mansi A.M.A., Status and ecology of Sirenian, Cetaceans and marine turtles in the Farasan Bank, Red Sea, Saudi Arabia. JKAU: Mar. Sci., Vol. 26. 1, pp: 1-8 (2016 A.D. / 1437 A.H.) DOI :10.4197/Mar. 26-1.1

Almahasheer. H., et. al., (2016). Decadal Stability of Red Sea Mangroves. Estuarine, Coastal and Shelf Science 169, 164-172. https://www.researchgate.net/profile/Hanan_Almahasheer2/publication/287146723_Decadal_Stability_of_Red_Sea_Mangroves/links/5a8eee84a6fdccecffffcd22/Decadal-Stability-of-Red-Sea-Mangroves.pdf?origin=publication_detail

Bogorodsky S.V., Randall J.E. (2019). Endemic Fishes of the Red Sea. In: Rasul N., Stewart I. (eds) Oceanographic and Biological Aspects of the Red Sea. Springer Oceanography. Springer, Cham. https://doi.org/10.1007/978-3-319-99417-8_14

Braun, Camrin D. et al. “Movements of the Reef Manta Ray (Manta Alfredi) in the Red Sea Using Satellite and Acoustic Telemetry.” Marine Biology 162.12 (2015): n. pag. Https://dspace.mit.edu/openaccess-disseminate/1721.1/104435

Bruckner, A.W., and Dempsey, A.C., (2015). The Status, Threats, and Resilience of Reef-Building Corals of the Saudi Arabian Red Sea. In: N.M.A. Rasul and I.C.F. Stewart (eds.), The Red Sea, The Formation, Morphology, Oceanography and Environment of a Young Ocean Basin. Springer Earth System Sciences, DOI 10.1007/978-3-662-45201-1_27, https://www.livingoceansfoundation.org/wp-content/uploads/2015/05/301431_1_En_27_Chapter_OnlinePDF.pdf

Cochran JEM, et. al., (2016) Population structure of a whale shark Rhincodon typus aggregation in the Red Sea. J Fish Biol 89: 1570−1582. https://onlinelibrary.wiley.com/doi/pdf/10.1111/jfb.13054

Cowburn, B., et. al., (2019). Healthy and diverse coral reefs in Djibouti A resilient reef system or few anthropogenic threats? Marine Pollution Bulletin 148, 182-193. https://doi.org/10.1016/j.marpolbul.2019.07.040

Dawson Shepherd, A., (2015). Review of legislation, strategies, policies and management plans for fisheries sectors in the PERSGA Countries of Djibouti, Jordan, Saudi Arabia, Sudan and Yemen. A Synthesis. Strategic Ecosystem Management of the Red Sea and Gulf of Aden Project. 15th November 2015 Draft. The Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of

Aden (PERSGA). Global Environment Facility (GEF). World Bank (WB). http://sem.persga.org/Documents/C2//Review_Nat_LMR_Leg_Pol_Regional_Draft.pdf

DeVantier, L.M., De'ath, G., Klaus R., Al-Moghrabi, S., Abdulaziz, M., Reinicke, G. & Cheung, C.P.S.(2004). Reef-building corals and coral communities of the Socotra Islands, Yemen: A zoogeographic 'crossroads' in the Arabian Sea. Fauna of Arabia 20: 117-168.

Fahmy, M.A., Fattah, L.M.A., Abdel-Halim, A.M., Aly-Eldeen, M.A., Abo-El-Khair, E.M., Ahdy, H.H., Hemeilly, A., El-Soud, A.A. and Shreadah, M.A. (2016) Evaluation of the Quality for the Egyptian Red Sea Coastal Waters during 2011-2013. Journal of Environmental Protection, 7, 1810-1834.http://dx.doi.org/10.4236/jep.2016.712145

FAO (1999). International Plan of Action for reducing incidental catch of seabirds in longline fisheries. International Plan of Action for the conservation and management of sharks. International Plan of Action for the management of fishing capacity. Rome, FAO. 1999. 26p. http://www.fao.org/ipoa-sharks/en/

FAO (2009). Fishing operations. 2. Best practices to reduce incidental catch of seabirds in capture fisheries. FAO Technical Guidelines for Responsible Fisheries. No. 1, Suppl. 2. Rome, FAO. 2009. 49p. http://www.fao.org/docrep/012/i1145e/i1145e00.pdf

Fejes, S., (2011). Mid-term and final evaluation. Promotion of strategies to reduce unintentional production of POPs in the Red Sea and Gulf of Aden (PERSGA) coastal zone (GF/RAB/08/006). https://open.unido.org/api/documents/4779576/download/Promotion%20of%20strategies%20to%20reduce%20unintentional%20production%20of%20POPs%20in%20the%20Red%20Sea%20and%20Gulf%20of%20Aden%20(PERSGA)%20coastal%20zone%20-%20MID-TERM%20and%20FINAL%20EVALUATION

Fischer, J., Erikstein, K., D'Offay, B., Barone, M. & Guggisberg, S. (2012). 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, FAO. 120 pp. http://www.fao.org/docrep/017/i3036e/i3036e.pdf

Furby, K.A., Bouwmeester, J., and Berumen, M.L., (2013). Susceptibility of central Red Sea corals during a major bleaching event. Coral Reefs. 32:505–513. Https://www.researchgate.net/publication/257397982_Susceptibility_of_central_Red_Sea_corals_during_a_major_bleaching_event

GoE (2006). Designation of Red Sea Northern Islands and Barrier Reefs as a Protected Area. Decree 1618/2006. Government of Arab Republic of Egypt. Http://extwprlegs1.fao.org/docs/pdf/egy68986.pdf (Arabic)

GoY (2009). Prime Ministerial (Cabinet) Decree No. (310) of 2009, concerning the Establishment of the North Kamaran Ilsand Protected Area. Government of Yemen. (Arabic)

Hanafy, M.H., (2012). Nesting of marine turtles on the Egyptian beaches of the Red Sea. Egypt. J. Aquat. Biol. & Fish., Vol. 16, No. 2: 59 - 71 (2012) ISSN 1110 –1131 Https://www.researchgate.net/publication/280298500_Nesting_of_marine_turtles_on_the_Egyptian_beaches_of_the_Red_Sea

Heileman, S., Mistafa, N., (2008). III-6 Red Sea: LME# 33, The UNEP Large Marine Ecosystem Report: A Perspective on Changing Conditions [in:] LMEs of the World's Regional Seas, K. Sherman & G. Hempel (eds.), UNEP Regional Seas, Report and Studies.

Hockings, M., Stolton, S., Leverington, F., Dudley, N. and Courrau, J. (2006). Evaluating Effectiveness: A framework for assessing management effectiveness of protected areas. 2nd edition. IUCN, Gland, Switzerland and Cambridge, UK. xiv + 105 pp. http://app.iucn.org/dbtw-wpd/edocs/PAG-014.pdf

IMO (2004). International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004. International Maritime Organisation. Https://cil.nus.edu.sg/wp-content/uploads/formidable/18/2004-International-Convention-for-the-Control-and-Management-of-Ships-ballast-water-and-sediments.pdf

IUCN, PERSGA, MEPA (1984a). Saudi Arabian Red Sea Survey Site Assessment Data Sheets Sectors 1-4. Report No. 7, Part 1. October 1984 International Union for the Conservation of Nature and Natural Resources (IUCN), Gland, Switzerland. Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), Meteorology and Environmental Protection Administration (MEPA). Jeddah, Saudi Arabia.

IUCN, PERSGA, MEPA (1984b). Saudi Arabian Red Sea Survey Site Assessment Data Sheets Sectors 1-4. Report No. 7, Part 2. October 1984 International Union for the Conservation of Nature and Natural Resources (IUCN), Gland, Switzerland.

Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), Meteorology and Environmental Protection Administration (MEPA). Jeddah, Saudi Arabia.

IUCN, PERSGA, MEPA (1985a). Saudi Arabian Red Sea Survey Site Assessment Data Sheets Sectors 5-8. Report No. 8, Part I. January 1985. International Union for the Conservation of Nature and Natural Resources (IUCN), Gland, Switzerland. Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), Meteorology and Environmental Protection Administration (MEPA). Jeddah, Saudi Arabia.

IUCN, PERSGA, MEPA (1985b). Saudi Arabian Red Sea Survey Site Assessment Data Sheets Sectors 5-8. Report No. 8, Part II. January 1985. International Union for the Conservation of Nature and Natural Resources (IUCN), Gland, Switzerland. Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), Meteorology and Environmental Protection Administration (MEPA). Jeddah, Saudi Arabia.

IUCN, PERSGA, MEPA (1985c). Saudi Arabian Red Sea Survey Site Assessment Data Sheets Sectors 9-14. Report No. 12, Part 1. July 1985. International Union for the Conservation of Nature and Natural Resources (IUCN), Gland, Switzerland. Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), Meteorology and Environmental Protection Administration (MEPA). Jeddah, Saudi Arabia.

IUCN, PERSGA, MEPA (1985d). Saudi Arabian Red Sea Survey Site Assessment Data Sheets Sectors 9-14. Report No. 12, Part 2. July 1985. International Union for the Conservation of Nature and Natural Resources (IUCN), Gland, Switzerland. Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), Meteorology and Environmental Protection Administration (MEPA). Jeddah, Saudi Arabia.

IUCN, PERSGA, MEPA (1985e). Saudi Arabian Red Sea Survey Site Assessment Data Sheets Sectors 9-14. Report No. 12, Part 3. July 1985. International Union for the Conservation of Nature and Natural Resources (IUCN), Gland, Switzerland. Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), Meteorology and Environmental Protection Administration (MEPA). Jeddah, Saudi Arabia.

References

Kessel ST, Elamin NA, Yurkowski DJ, Chekchak T, Walter RP, Klaus R, et al. (2017). Conservation of reef manta rays (Manta alfredi) in a UNESCO World Heritage Site: Large-scale island development or sustainable tourism? PLoS ONE 12(10): e0185419. https://doi.org/10.1371/journal.pone.0185419

Khalaf, M.A., (2015). Review of legislation, strategies, policies and management plans for fisheries sectors in PERSGA Countries. Jordan. Strategic Ecosystem Management of the Red Sea and Gulf of Aden Project. Draft Final Report. 22nd April 2015. Programme for the Environment of the Red Sea and Gulf of Aden (PERSGA). Global Environment Facility (GEF). World Bank (WB). http://sem.persga.org/Documents/C2/Review_Nat_LMR_Leg_Pol_Jordan_Draft.pdf

Klaus, R., Kemp, J., Samoilys, M., Anlauf, H., El Din, S & O Abdalla, E & Chekchak, T. (2008). Ecological patterns and status of the reefs of Sudan. Proc 11th Int Coral Reef Sym. Https://www.researchgate.net/profile/Melita_Samoilys/publication/267781121_Ecological_patterns_and_status_of_the_reefs_of_Sudan/links/54e444d80cf2dbf606957a13/Ecological-patterns-and-status-of-the-reefs-of-Sudan.pdf?origin=publication_detail

Marsh, H. & Sobtzick, S. (2015). Dugong dugon. The IUCN Red List of Threatened Species 2015: e.T6909A43792211. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T6909A43792211.en.

MSS (2003-2016) Environmental Appraisal of the Jordanian Coast of the Gulf of Aqaba, Red Sea Jordan's National Monitoring Program. Annual reports 2003-2016. Designed and implemented by The Marine Science Station, Aqaba University of Jordan / Yarmouk University in collaboration with The Environment Commission Aqaba Special Economic Zone Authority Aqaba Jordan.

Monroe A.A, Ziegler M, Roik A, Ro¨thig T, Hardenstine RS, Emms MA, et al., (2018) In situ observations of coral bleaching in the central Saudi Arabian Red Sea during the 2015/2016 global coral bleaching event. PLoS ONE 13(4): e0195814. https://doi.org/10.1371/journal.pone.0195814.

Moritz C., et. al., (editors), (2018). Status and Trends of Coral Reefs of the Pacific. Global Coral Reef Monitoring Network https://www.sprep.org/sites/default/files/documents/publications/status-coral-reefs-pacific.pdf

Notarbartolo di Sciara G., Kerem D., Smeenk C., Rudolph P., Cesario A., Costa M., Elasar M., Feingold D., Fumagalli M., Goffman O., Hadar N., Mebrathu Y.T., Scheinin A.(2017). Cetaceans of the Red Sea. CMS Technical Series 33, 86 p. https://www.cms.int/sites/default/files/publication/red_sea_cetaceans_report_web_final.pdf

Osman E.O. et. al., (2018). Thermal refugia against coral bleaching throughout the northern Red Sea. Global Change Biology. Volume24, Issue2 February 2018. Pages e474-e484 https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.13895

PERSGA (1982a). Jeddah Convention. Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment. Http://www.persga.org/Documents/Doc_62_20090211112825.pdf

PERSGA (1982b). Protocol concerning regional co-operation in combating pollution by oil and other harmful substances in cases of emergency. Jeddah, 14 February 1982. PERSGA. Http://www2.ecolex.org/server2neu.php/libcat/docs/TRE/Full/En/TRE-000745.txt1982

PERSGA (2002). A Regional Network of Marine Protected Areas. Survey design for Proposed Marine Protected Areas Isles des Sept Frères & Ras Siyyan, Djibouti, Aibat & Saad ed Din, NW Somalia, Mukkawar (Magarsam) Island and Dungonab Bay, Sudan, Bir Ali - Belhaf, Yemen. PERSGA - SAP.

PERSGA (2005a). Protocol Concerning the Protection of the Marine Environment from Land-Based Activities in the Red Sea and Gulf of Aden. PERSGA. http://www.persga.org/Documents/Doc_62_20090211124355.pdf

PERSGA (2005b). The Protocol Concerning the Conservation of Biological diversity and the Establishment of a Network of Protected Areas in the Red Sea and Gulf of Aden. PERSGA. http://www.persga.org/Documents/Doc_62_20090211123942.pdf

PERSGA (2006). State of the Marine Environment, Report for the Red Sea and Gulf of Aden. PERSGA, Jeddah. https://www.cbd.int/doc/meetings/mar/ebsaws-2015-02/other/ebsaws-2015-02-persga-submission1-en.pdf

PERSGA. 2010. The Status of Coral Reefs in the Red Sea and Gulf of Aden: 2009. PERSGA Technical Series Number 16, PERSGA, Jeddah.http://www.persga.org/Files///Common/Flipping_Books_Downloads/Coral_Reef_Status_Report_2009.pdf

PERSGA (2014a). Regional Workshop on Wastewater Management and Pollution Loads Assessment in Coastal Cities of the Red Sea and Gulf of Aden. June 16th – 18th 2014, Jeddah, Saudi Arabia. Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA).

PERSGA (2014b). Coastal Marine Litter Assessment Guidelines of the Red Sea and Gulf of Aden. PERSGA Guideline Number GD.0021. PERSGA, Jeddah, Saudi Arabia.

PERSGA (2019a). SOMERSGA II Access Database. Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA).

PERSGA (2019b). SOMERSGA II KMZ file. Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA).

PERSGA (2019c). Guidelines to Prepare National Action Plans to Manage Marine Litter in the PERSGA Region. Report Number GD.0034. PERSGA, Jeddah, Saudi Arabia.

PERSGA/ALECSO. 2003. Survey of Habitats in Djibouti and Plans for their Protection. PERSGA Technical Series No. 5. PERSGA, Jeddah. http://www.persga.org/Publications/Technical/pdf/4%20Technical%20Series/TS5%20Survey%20of%20Habitats%20in%20Djibouti.pdf

PERSGA/GEF 2003. Status of Breeding Seabirds in the Red Sea and Gulf of Aden. PERSGA Technical Series No. 8. PERSGA, Jeddah. www.persga.org/Files//Publications/Technical/TS/TS8_Status_of_Breeding_Seabirds.pdf

PERSGA/GEF. 2004. Status of Mangroves in the Red Sea and Gulf of Aden. PERSGA Technical Series No. 11. PERSGA, Jeddah. http://www.persga.org/Documents/Mangroves_Status.pdf

PERSGA/UNE. 2018. Regional Action Plan for the Sustainable Management of Marine Litter in the Red Sea and Gulf of Aden. Report Number RP 0091. PERSGA, Jeddah, Saudi Arabia.

PERSGA/UNEP. 2008. Marine Litter in the PERSGA Region. PERSGA, Jeddah. Http://www.persga.org//Files/Common/Flipping_Books_Downloads/Marine_Litter_in_the_PERSGA_Region.pdf

Preen, A. (1989): The status and conservation of Dugong in the Arabian Region. MEPA Coastal and Marine Management Series Technical Report No. 10. Vol. 1. p.200. Meteorological and Environmental Protection Administration (MEPA). Saudi Arabia.

Rouphael, A., (2018). Report on the Final Evaluation of the Project. Red Sea and Gulf of Aden Strategic Ecosystem Management Project (SEM Project). Regional Organisation for Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA). http://sem.persga.org/Documents/Independent_consultant_report_on_final_evaluation.pdf

Rouphael, A.B., and Al-Yami, H., (2000). Temporal Variation in Abundances of Marine Organisms, Farasan Islands Marine Protected Area, Saudi Arabia. Report 4. May 2000. National Commission for Wildlife Conservation and Development (NCWCD). Kingdom of Saudi Arabia.

Shawky, Ahmed & Sallam, Wafaa & A Alwany, Magdy & A Mohammad, Deyaaedin & mohammed, S.Z.. (2017). PHOTO IDENTIFICATION OF DUGONGS IN MARSA ALAM AND WADI EL GEMAL NATIONAL PARK, EGYPTIAN COAST OF THE RED SEA. Al Azhar Bulletin of Science Vol. 28, No. 2 (December), 2017, pp. 1-10. https://www.researchgate.net/publication/325908659_PHOTO_IDENTIFICATION_OF_DUGONGS_IN_MARSA_ALAM_AND_WADI_EL_GEMAL_NATIONAL_PARK_EGYPTIAN_COAST_OF_THE_RED_SEA

Shobrak, M. Y., & Aloufi, A. A. (2014). Status of breeding seabirds on the Northern Islands of the Red Sea, Saudi Arabia. Saudi Journal of Biological Sciences, 21(3), 238–249. http://doi.org/10.1016/j.sjbs.2013.11.002

Tesfamichael, D., (2012). Assessment of the Red Sea Ecosystem with emphasis on fisheries. PhD thesis. July 2012. University of British Columbia. Canada.

Turak, E., et. al., (2007). Reef-building corals and coral communities of the Yemen Red Sea. FAUNA OF ARABIA 23: 1–40. 15.07.2007. https://researchonline.jcu.edu.au/3000/1/3000_Turak_2007.pdf

UN (2015). Paris Agreement to the United Nations Framework Convention on Climate Change. http://unfccc.int/paris_agreement/items/9485.php, http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf

UN (2020). World Ocean Assessment II. Output of the second cycle of the Regular Process. Final Unedited Draft. 19th November 2020. Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects (Regular Process). United Nations. Https://www.un.org/regularprocess/sites/www.un.org.regularprocess/files/woaii-4th_and_final_draft_18nov_to_14th_ahwgw_in_tc.pdf

UNEP (1995). Global Programme of Action for the protection of the marine environment from land-based activities. UNEP(OCA)/LBA/IG.2/7 5 December 1995. United Nations Environment Programme. https://papersmart.unon.org/resolution/uploads/1995-gpa.pdf

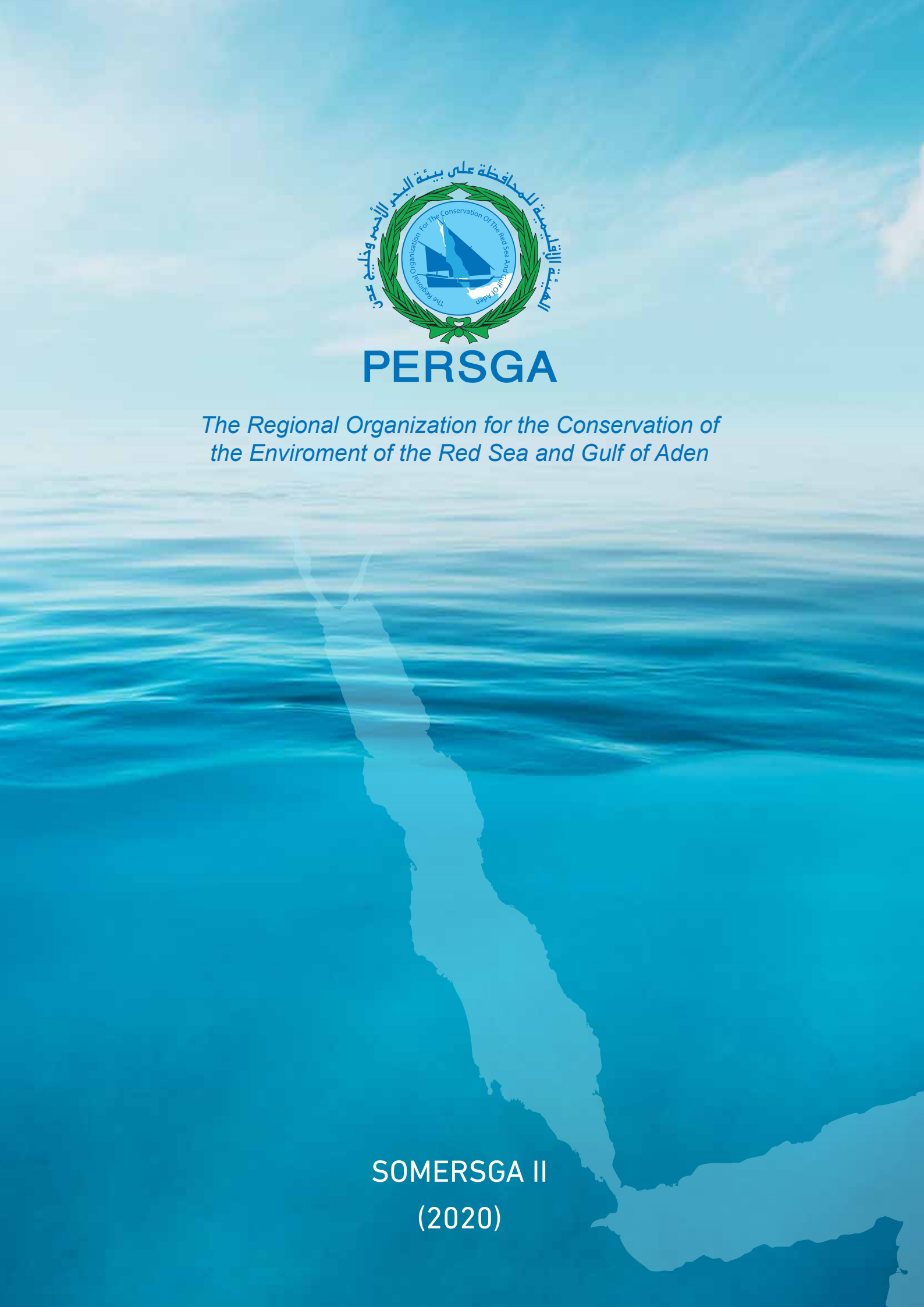
UNEP (2018). Review of the implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities at the national, regional and international levels during the period 20122018. United Nations Environment Programme. UNEP/GPA/IGR.4/2/Rev.1. https://papersmart.unon.org/igr-meeting/sites/default/files/k1802555.pdf

UNGA (2015). Transforming our world: the 2030 Agenda for Sustainable Development. A/Res/70/1. 25th September 2015. United Nations General Assembly. https://sustainabledevelopment.un.org/post2015/transformingourworld.

UNGA (2016). The First Global Integrated Marine Assessment. World Ocean Assessment I. Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects. Group of Experts of the Regular Process. United Nations General Assembly. http://www.un.org/Depts/los/global_reporting/WOA_RPROC/WOACompilation.pdf and https://www.un.org/Depts/los/global_reporting/WOA_RegProcess.htm

World Bank (2004). Score card to assess the Progress in Achieving Management Effectiveness Goals for Marine Protected Areas. Pp. 30. July 2004.http://documents.worldbank.org/curated/en/101301468135588216/pdf/32938a10ScoreC1rogress200401public1.pdf

YLNG (2015). Balhaf Headland Marine Area Biodiversity Action Plan Operations Phase. Yemen LNG Company. Https://earthmind.org/sites/default/files/2015-05-VCA-Balhaf-Plan_1.pdf



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