Review of existing assessments and findings

3

This chapter provides an overview of existing marine assessments and summarizes the main findings of the Group of Experts' review, in relation to both assessment product and assessment process. The assessments have been examined at three different levels: individual assessments, regional assessments and global and supra-regional assessments. Summaries of the regional and global/supra-regional assessments are found in the annexes to the full report. Information about individual assessments is included in the GRAME database described in Box 3.1. Chapter 3 considers strengths, gaps and needs within each region and at larger scales. In particular, it aims to clarify existing capacity and technical approaches for assessments and the range of processes currently used to plan and deliver assessments. It examines the various data types and methods used in assessments and describes the most common features of existing assessment processes. A final section summarizes capabilities for assessing ecological and multi-sectoral interactions and broad-scale patterns within and across regions.

INTRODUCTION

3.1 One of the basic tenets of the mandate for the Group of Experts is that a global assessment must build on existing assessments. This chapter examines existing assessments to identify available building blocks for a global assessment process. More specifically, the objectives are to:

a. Identify main features of the existing assessment products including the types of data they incorporate, which parts of the marine environment they cover, the general analytical approach adopted, the degree to which they integrate knowledge across ecosystem components and sectors of human activity and include socio-economic as well as environmental aspects;

b. Identify the main characteristics of processes that led to existing assessments;

c. Evaluate the capacity to conduct assessments that provide a basis for advice to policy-makers at international level (regional, supra-regional, global); and

d. Identify the main building blocks that are available for a Regular Process, as well as the gaps that need to be filled.

3.2 In collating information on existing practices, the Group of Experts used a very broad definition of *assessment* to capture the various activities that could contribute to the Regular Process (see Chapter 2). This forms the basis for the descriptions of available building blocks presented in this chapter. In considering gaps to be filled, the point of departure is that the Regular Process should aim, as appropriate, to deliver fully integrated assessments as described in Chapter 2.

3.3 The summary and analysis in this Chapter form the basis for an analysis of best practices in Chapter 4. In considering assessment *products*, the normative analysis in Chapter 4 gives standard descriptions of sound data and methods for assessments, including the treatment of natural variation (see Chapter 4). "Sound" refers to data and methodology that meet disciplinary standards for reliability and representativeness, and that are managed in ways that allow them to be recovered, re-used by other investigators, disseminated broadly, and replicated in different assessment contexts.[1] For assessment *processes,* the standards are less broadly accepted and therefore the Group of Experts refined existing standards for the analysis in Chapter 4, based on judgments by the Group of process aspects that promote "relevance", "legitimacy" and "credibility".

APPROACH TAKEN

3.4 The Group of Experts has examined existing assessments at three different levels:

a. Individual assessments, available in the GRAMED (see Box 3.1) (http://www.unep-wcmc.org/GRAMED/);
b. On a regional basis, through summaries available in Annex IV; and
c. Through summaries of assessments that are global or supra-regional in scale and focused either on a particular theme, sector or assessment process, as available in Annex V.

3.5 Assembly of all assessments examined was carried out by members of the Group of Experts and supplemented by other experts as

1 For example, in an interdisciplinary assessment, it is important to ensure that the highest standards have been adhered to for each component discipline, using accepted standards and methods from that discipline (e.g., fisheries or climate change).

Box 3.1: **The global and regional assessments of the marine environment database**

The GRAMED is a dynamic online, fully searchable tool which provides access to the largest existing collection of information on assessments, scientific research studies and data holdings of relevance to the marine and coastal environment at the national, regional and supra-regional scale. To date it is the only database of its kind.

The database has been developed at the request of UNEP and IOC-UNESCO, as the lead agencies for the "Assessment of Assessments" (AoA). It has been developed by UNEP-WCMC with the support of the governments of the Netherlands and the UK as a resource to support the Group of Experts as well as a broader range of those working towards the sustainable use of our oceans.

The database has multiple access levels for different types of users and target groups. This includes public access to browse, interrogate and download data as well as password protected sections for data inputting, review and editing. The structure of the database reflects the data provided through over 250 templates developed by members of the Group of Experts and other experts during the AoA process. It continues to evolve.

How has it been used?
Within the AoA process, the database has been used as an online mechanism to consolidate information on assessments and other activities and to facilitate access to this information by the Group of Experts. It is beginning to be used by parties beyond the AoA process.

How could it be useful for the Regular Process?
The GRAMED could play a useful role in the Regular Process. It provides metadata on over 60 attributes for approximately 500 global, regional and national activities to date. Attributes include information on both process and products, including, where possible, direct links to online information. The logical and systematic structure makes this information accessible to a wide range of national, regional and global stakeholders. Its facilities for online data entry, remote data authorization and user feedback strive to ensure the lowest possible costs for ongoing maintenance and data entry. As new assessments and activities are undertaken, these can be added to the database but quality control procedures will be needed to ensure consistency across the database.

needed. To a large degree the range of information depended on the experience and networks of the responsible experts and has built on the GRAMED.[2]

3.6 The Group of Experts encountered several challenges in their efforts to examine the data and processes behind the assessments.

2 The assembled information is not comprehensive and undoubtedly can be supplemented after release of this report.

Few processes were found to be documented thoroughly and the terminology used for documenting practices in assessment processes is much less systematic than that used in documenting data and analytical methods. With regard to assessment products, the scale of the task did not allow the Group to undertake detailed examinations of the strengths and weaknesses of specific datasets and analytical methods used in individual assessments. However, the Group of Experts noted that standards for data quality and analytical methods are widely accepted by the research community and therefore assumed that these standards were generally adhered to in the individual assessment analyses considered here.

Individual assessment analyses

3.7 The Group of Experts surveyed the available assessments and reviewed a selection for each region and of the supra-regional and global summaries, gaining insights that could be applied in the design of a Regular Process and identifying good candidates for building blocks. In some cases, a single review covered a large suite of assessments that produced similar products and followed consistent processes, such as the regular fish stock assessments undertaken by a Regional Fisheries Management Organization (RFMO). At the regional level, priority was given to assessments that integrated several thematic areas and/or covered large geographical areas. Most assessments considered were conducted within the last decade, though no attempt was made to restrict the timeframe for including individual analyses in this review.

3.8 The review followed a template with questions concerning (see Annex VII):

a. Institutional arrangements
b. Context of the assessment including mandate and relation to policy cycle
c. Geographical, temporal, and thematic coverage
d. Sources and types of information, general methods for analysis and interpretation of results
e. Process, including use of different types of knowledge, nature of participation and methods for quality assurance
f. Communication of the results
g. Recommendations for future actions on policy or information needs
h. Review of the process and products

3.9 The questions were answered as factually as possible given the information that was available. In addition, the template included a set of questions inviting the experts' opinion on how well the assessment communicated its results, its credibility and influence, and general comments about strengths and weaknesses.

3.10 The reviews of individual assessments have been used as input to the regional summaries and, in some cases, to the supra-regional and global summaries noted below. In addition, they have been used as a basic information source for Chapter 4 which discusses best practices. The number of individual assessment analyses considered in each region is tabulated in the database (Tables 3.1a, b).

Regional summary assessments

3.11 A similar approach as for the individual assessments was used to review assessment practices and coverage in each marine region through a regional summary template (see Annex VI). As noted above, the assessment analyses for each region did not necessarily cover a consistent timeframe but generally occurred over the last decade. The regional summary, therefore, is an overview of recent assessment information in each region based on the work and expertise of the Group of Experts. The additional topics covered in the regional summaries (see Annex IV) are:

a. Name of the AoA region
b. Broad ecological characteristics
c. Institutions undertaking assessments
d. Data availability
e. Scope of assessments undertaken
f. Prioritized issues
g. Supra-regional issues
h. Capacity of the region to undertake future assessments

3.12 The consolidation of the reviews of individual assessments was a key input to the assessment of regional assessment practices. Experts also used their own knowledge of the region and consulted with colleagues and organizations working in the region. Therefore the analyses tabulated below and in the Annex are not strictly limited to individual assessment analyses contained in the database; they reflect the expert judgment of the members of the Group of Experts.

Global or supra-regional summary assessments

3.13 Another perspective on building blocks for a global marine assessment can be gained by looking at the assessment coverage of a particular sector of human activity, or theme of interest, over several of the AoA regions or in some cases all the world's oceans. Some supra-regional assessment efforts were reviewed using a similar template as for the regional assessments. The following topics are covered:

a. Shipping
b. Alien invasive species
c. Fisheries and aquaculture
d. Climate change: warming, ocean circulation, sea level rise, acidification
e. Marine biodiversity
f. Pollution from land-based activities
g. Coastal development: urban development, tourism and coastal zone management
h. Pollution of the open oceans, including inputs from shipping and the atmosphere

3.14 Supra-regional or global assessment activities often develop around a particular approach or through a particular group. Without attempting to cover all such efforts exhaustively in the limited time available, summaries of the following were reviewed by the Group of Experts (Annex V):

a. Global Environment Facility (GEF) Large Marine Ecosystems (LMEs)
b. Global Environment Outlook (GEO)
c. Millennium Ecosystem Assessment (MA)
d. Global Open Oceans and Deep Seabed Biogeographic classification (GOODS)
e. Global International Waters Assessment (GIWA)
f. Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)
g. London Convention on the Prevention of Marine Pollution by Dumping of Wastes and other matter
h. FAO State of World Fisheries and Aquaculture (SOFIA)[3]
i. IUCN Red List of Threatened Species (IUCN)[4]

3 There is no separate supra-regional summary of this process. It is referred to in the Fisheries and Aquaculture supra-regional summary in Annex V.

4 There is no separate supra-regional summary of this process. It is summarized in Annex II.

Of these, two focus exclusively on the marine environment (LMEs, GESAMP), one on marine and freshwater environments and linkages between them (GIWA), and four encompass marine concerns within a more comprehensive scope (MA, GEO, FAO, IUCN). Information from these summaries was used primarily in the gap analysis in Table 3.1 below. It was also a supplemental contribution to the findings in Chapters 3 and 4.

3.15 It is important to note that assessments of non-living resources (e.g., mineral resources) are not included in the regional summaries or in the overview analysis. While these resources are certainly important, they are not often the subject of regular, ongoing, publicly available assessments of status and trends that would constitute part of the Regular Process. Of course they could be included in future when appropriate information on status and trends of such resources becomes publicly available.

Tabulating and summarizing information from the templates

Approach to summarizing assessment products

3.16 The relatively consistent information on assessment products in the individual and regional templates, along with expert judgment of members of the Group of Experts, allowed a systematic tabulation of both the coverage and treatment of key ecosystem properties in assessments across regions. The following categories of information concerning ecosystem status and trends were considered in this overview analysis:

a. Water Quality
b. Living Marine Resources
c. Habitat Characterizations and Impacts
d. Lower Trophic Levels in the Food Web (i.e. primary and secondary productivity)
e. Protected Species
f. Social and Economic Conditions with respect to the Marine Environment

These categories were chosen to span ecosystem attributes that are both dynamic and subject to the impacts of human activities. Therefore, they are appropriate for regular assessment and are likely to form building blocks for the Regular Process. In addition,

the analysis considered particular features that enhance an assessment's *influence*. In this context, the following features relevant to the application of assessments to policy making were considered:

g. Use of Indicators of Status or Reference Points
h. Analysis of Policy Alternatives
i. Integration of Assessments across Sectors and/or Ecosystem Components
j. Capacity for Ongoing Assessment Work

Approach to drawing conclusions about assessment processes

3.17 Regarding assessment processes, as noted earlier the Group of Experts was asked to consider the extent to which the existing range of assessment mechanisms effectively inform policy-makers at national, regional and global levels. The information sought on assessment processes reflects these and other questions but there was no standardized system for reporting the information. Within regions, processes vary widely among institutions and themes, so there was no meaningful way to generalize at the regional level. Consequently, all the templates of individual assessments were reviewed for information on the nature of the processes that produced them. Information was sought on the following aspects (see Annex VII):

a. Nature of the assessment organization
b. Objectives and scope (coverage)
c. The science/policy relationship
d. Participation of non-governmental stakeholders
e. Selection of experts
f. Means for quality assurance
g. Availability of data and metadata
h. Interaction among experts and the treatment of lack of consensus
i. Peer review
j. Means of communicating assessment results to the public
k. Capacity building
l. Post-assessment evaluation of the assessment process

3.18 Assessment processes at the supra-regional level also vary widely. The Group of Experts did not seek detailed *process* information at that scale beyond the nature of the organizations carrying out the

assessments. However, for many supra-regional and a few regional assessment processes that are well-established, supplementary information on the *processes* was acquired from official websites and through further discussions among Group members (see also Chapters 2 and 4 and references cited therein).

3.19 Because it was not possible to systematically generalize about assessment *processes* at regional and supra-regional scales, the findings on process given below are primarily descriptive. They summarize the array of practices found, noting any that were widespread and drawing attention to especially creative or noteworthy examples. Despite limitations on the ability to generalize among assessment processes, the findings are valuable in pointing towards what is needed if assessment processes are to be influential. They lead into the discussion of "best practices" in Chapter 4.

REVIEW OF REGIONAL AND SUPRA-REGIONAL ASSESSMENTS

Regional summaries – an overview

3.20 The following overview (Table 3.1) of the extent and comprehensiveness of assessments across regions was developed as part of the analysis conducted by the Group of Experts.

3.21 Table 3.1a provides an indication of the coverage and extent of the regional assessments examined (see Annex IV) and Table 3.1b shows the extent to which they incorporate certain features that might provide a basis for designing a Regular Process. Due to the nature of the information in the templates, these analyses rely on professional judgments rather than quantifiable criteria and are not intended to reflect technical merit. The 21 AoA regions (shown in the Tables below) are also presented in the AoA map on page 16.

Table 3.1a: **Gap analysis of the coverage of ecosystem properties in regional marine assessments**

	Water Quality	Living Marine Resources	Habitat Characterizations and Impacts	Lower Trophic levels in the Food Web	Protected Species	Social and Economic Conditions
Southern Ocean	some	extensive	some	extensive	extensive	some
Arctic Ocean	extensive	good	some	good	good	good
Baltic Sea	extensive	extensive	good	extensive	extensive	good
Black Sea	some	good	some	some	some	some
East Asian Seas	good	some	good	some	some	some
Eastern African Seas	some	some	some	some	some	some
Mediterranean Sea	extensive	extensive	good	good	good	some
North Central Pacific Ocean	some	extensive	extensive	good	good	good
North East Atlantic Ocean	extensive	extensive	good	extensive	extensive	good
North East Pacific Ocean	extensive	extensive	good	extensive	extensive	good
North West Atlantic Ocean	extensive	extensive	good	extensive	extensive	good
North West Pacific Ocean	good	good	good	some	good	some
Red Sea and Gulf of Aden	some	some	some	some	unknown	some
ROPME/RECOFI Area	good	some	some	some	some	some
South Asian Seas	some	some	some	good	good	some
South East Pacific Ocean	some	good	some	some	unknown	some
Southern Indian Ocean	some	good	good	good	good	good
Southern Pacific Ocean	some	some	good	none	some	some
South West Atlantic Ocean	some	some	some	some	good	good
Western African Seas	some	some	some	some	some	some
Wider Caribbean Region	good	good	good	some	good	good

extensive; good; some; none; unknown

Extent of the assessment information available on ecosystem status and trends

Water Quality

- Some time series of water quality data are available for a **substantial portion** of the region covering **some important attributes.***
- Time series on **multiple attributes*** and **some analyses** are available.
- **Multiple attributes*** are **regularly analyzed** in periodic assessments.

(*Water quality attributes include *physical conditions* (sediments, temperature, suspended solids etc); *pH* and related constituents such as CO_2; *Pathogens*; *Oxygen-consuming substances*; *Toxic substances* and substances that *accumulate* in food chains; *Nutrients* etc.)

Living Marine Resources

- Assessments of **some important species** in the region are available.
- Assessments of most **major exploited species** in the region are available.
- Assessments of **major and minor species and interactions among them** are **regularly prepared**.

Habitat Characterization and Impacts

- Assessments* of status and trends of **habitat quality** and **extent** (habitats such as coral reefs, seagrass beds, wetlands) are available for **some portion** of the region covering **some** important **biophysical features**.
- Assessments of status and trends in habitats covering **multiple biophysical features** are available for a **substantial portion of the region**.
- Assessments of **multiple biophysical features** are **regularly prepared** covering most of the region.

(*Data on habitats may be both quantitative and qualitative but must be clearly defined.)

Lower Trophic levels

- Assessments of status and trends of **some aspects of primary and secondary productivity** are available for **some portion** of the region.
- Assessments of status and trends of **multiple attributes related to primary and secondary productivity** are available for a **substantial portion of the region**.
- Assessments of status and trends of **multiple attributes** are **analyzed** in periodic assessments covering most of the region.

Protected Species

- Assessments of status and trends of **some** protected species designated for specific conservation measures (marine mammals, sea birds, turtles etc.) are available but not on a regular basis.
- Assessments of status and trends of **most** protected species designated for specific conservation measures (marine mammals, sea birds, turtles etc.) are available but not on a regular basis.
- Assessments of status and trends of **most** protected species **regularly analyzed** in periodic assessments.

Social and Economic Conditions

(This category relates *only* to social and economic conditions and does not consider whether or not that information is integrated with biophysical information on marine ecosystems).

- Assessments of status and trends of **some social and economic factors for some portions** of the region are available on an irregular basis.***
- Assessments of status and trends of **multiple social and economic factors** are available for a **substantial portion of the region**.
- Assessments of status and trends of **multiple social and economic factors** are **regularly analyzed** in periodic assessments covering **most of the region**.

(*** Data and analyses on these factors could include scale and value of goods and services derived by human society from coastal and marine areas as well as the impacts of human activities on marine ecosystem components insofar as they affect human health, food supply/nutrition or economic sectors like fishing, and loss/degradation of ecosystem services.)

Table 3.1b: **Factors affecting the influence of regional assessments**

	Indicators/ Reference Points	Analysis of Policy Alternatives	Integration of Assessments across sectors and/or Ecosystem Components	Capacity for ongoing Assessments work
Southern Ocean	◒	●	○	◒
Arctic Ocean	◌	◓	◒	●
Baltic Sea	●	●	◒	●
Black Sea	◌	○	◓	◓
East Asian Seas	◓	◒	◒	◒
Eastern African Seas	○	◓	◓	◓
Mediterranean Sea	◒	◒	◓	◒
North Central Pacific Ocean	◓	◒	◒	◒
North East Atlantic Ocean	◒	◒	◒	●
North East Pacific Ocean	◒	●	●	●
North West Atlantic Ocean	◒	●	◒	●
North West Pacific Ocean	◓	◒	◒	◒
Red Sea and Gulf of Aden	○	◒	◓	◓
ROPME/RECOFI Area	○	◓	◓	◓

Table 3.1b: **Factors affecting the influence of regional assessments** *continued*

	Indicators/ Reference Points	Analysis of Policy Alternatives	Integration of Assessments across sectors and/or Ecosystem Components	Capacity for ongoing Assessments work
South Asian Seas	○	◔	◔	◔
South East Pacific Ocean	◌	◕	◕	◔
Southern Indian Ocean	◕	◕	◕	●
Southern Pacific Ocean	◔	◔	◔	◕
South West Atlantic Ocean	◔	◔	◔	◕
Western African Seas	◔	◔	◔	◔
Wider Caribbean Region	◌	◔	◔	◔

● extensive; ◕ good; ◔ some; ○ none; ◌ unknown

Framing of assessment results for the region

Indicators/Reference Points

◔ Indicators are available for **some important attributes** in relation to water quality, biodiversity, fisheries, etc. are available but may not be regularly updated.

◕ Indicators and some **reference points** for **some attributes are available**, as well as associated **interpretations for decision-makers**.

● Indicators with reference points are **regularly** used in **periodic** assessments for **multiple important attributes** and **advice with respect to these indicators** is part of the assessment process.

Analysis of Policy Alternatives

◔ Assessments make **some comments on policy issues** and are available to **policy-makers**.

◕ Some **policy implications of the findings are considered** and **policy options analyzed**.

● Assessment results are iterative and **regularly used to shape policy** in the region. **Policy-makers interact with scientists** and **alternatives, including past policy performance, are analyzed** as part of the process.

Integration of Assessments across Sectors and/or Ecosystem Components

◔ Some assessments (such as sectoral/habitat/species) consider **several ecosystem components** or **sectors of activities together**. At least **qualitative integration** of results is available.

- Some assessments considering **multiple ecosystem components or sectors** to provide **integrated analysis, both qualitatively and quantitatively**, to inform the analysis of policy options on an irregular basis.
- Integrated assessments are a **regular part of the assessment process regionally.** These assessments are a **major vehicle for advising policy-makers** on a **regular basis**.

Capacity to perform assessments on an ongoing basis

This involves consideration of the potential availability of qualified technical personnel and institutional infrastructure (data and data management capacity, modelers and data analysts, experts in use of traditional knowledge, funding etc.).

Capacity

- **Trained technical personnel** are available for **some relevant issues** (ecosystem components/sectors)
- **Personnel** and **some systematically collected** and *archived data* are available for **many relevant issues**.
- **Personnel**, science infrastructure and **data** are available and **well- funded** for **most sectors** and **issues.**

Supra-regional and global assessments – an overview

3.22 The Group of Experts considered that there are major issues relating to the marine environment that cross regional boundaries and are global or ocean-wide in scope. These issues have been the subject of important assessment activities that could contribute to the Regular Process. Some of these assessments are ongoing and continuous and will provide a foundation for a Regular Process. Others are one-off assessments from which lessons may be drawn. Table 3.2 is intended to be illustrative of several major assessments processes; it is by no means exhaustive. Some supra-regional thematic issues, such as land-based sources of pollution, coastal development and marine biodiversity, are covered by assessments carried out by a large number of organizations and their approaches and coverage vary within and across regions. It is therefore not possible to carry out the same analysis as in Table 3.1.

Table 3.2: **Scope of supra-regional and global assessments**

Processes	Thematic/ sectoral Coverage	Regularity of Assessments	Integration of Assessments across sectors and/or Ecosystem Components	Analysis of Policy Alternatives	Social and Economic Conditions
FAO SOFIA	Fisheries and aquaculture	●	○	◔	◕
Assessments produced by GESAMP	Thematic issues – including for the open ocean	●	○	◔	○
Global Environment Outlook	Thematic issues and human-environment interactions in marine and other environments	●	◕	◕	◔
Large Marine Ecosystems	Thematic issues relevant to particular marine ecosystems including social and economic conditions	◔	◕	◔	●
Millennium Ecosystem Assessment	Ecosystem status and trends in marine and other environments	○	◕	◔	●
IUCN Red-list Assessments	Risk of extinction of individual species	●	○	◔	○
GIWA	International marine and fresh waters	◔	◕	◔	◕

● extensive; ◕ good; ◔ some; ○ none; ◌ unknown

Criteria used for the gap analysis of supra-regional assessments

Regularity of Assessments

◔ Assessments are conducted on an *ad hoc or "one-off"* basis.

◕ Assessments do not follow a formalized, regular cycle but have been conducted and updated more than once.

● Assessments follow a regular assessment cycle.

Integration of Assessments across Sectors and/or Ecosystem Components

- Assessment is multi-disciplinary in nature, covering **several ecosystem components** and/or **sectoral activities** over similar spatial and temporal scales.
- Assessment is **integrated** across **some components or sectors** to consider **common patterns and trends** to inform the **analysis of policy options**.
- An **integrated** assessment across **most major components or sectors** is **regularly** conducted at the regional level as a basis for **analysis and advice on policy options**.

Analysis of policy alternatives

- Assessment comments generally on policy issues and is readily available to relevant **policy-makers**.
- Assessment analyzes some **policy implications of the findings** and **options are analyzed**.
- Assessment results are iterative and regularly used to **inform policy**, **analyze options** and include an **evaluation of policy performance**.

Social and economic conditions

- Assessments of status and trends of **some social and economic factors for some portions** of the sector or theme are available on an irregular basis.***
- Assessments of status and trends of **multiple social and economic factors** for a **substantial portion of the sector or theme** are available.
- Assessments of status and trends of **multiple social and economic factors** are **regularly analyzed** in periodic assessments covering **most of the sector or theme**.

3.23 Usually, these supra-regional assessments are undertaken under the auspices of international organizations that cover some specific aspects of the marine environment in several regions and/or at the global scale. They may assess a specific economic sector or selected properties of the marine environment. Accordingly, they contain a large amount of applicable information but by no means constitute a global marine assessment, even in aggregate.

3.24 In overview, such supra-regional assessments and other large regional or global efforts need to be integrated in order to make a major contribution to the Regular Process. Certain databases developed for such assessments are a major resource for future integrated assessments. Three examples are: The Food and Agriculture Organization (FAO) currently summarizes

fishery catch and effort statistics from around the world, an extremely challenging task; the International Oceanographic Data and Information Exchange (IODE) of the Intergovernmental Oceanographic Commission (UNESCO-IOC) was established to enhance marine research, exploitation and development by facilitating the exchange of oceanographic data and information between participating member states and by meeting needs for data and information products; the Census of Marine Life (CoML) Ocean Biogeographic Information System (OBIS) contains a large and expanding compilation of marine biodiversity information. It is important to acknowledge and build upon such compilations as part of the Regular Process, to ensure the data are interoperable (similar components in different databases can be related to one another) and to strengthen these efforts as an international priority. However, for such efforts to be effective, the data and information must be linked to policy-making efforts to allow changes in status and trends to be related to policy actions, or a lack thereof.

3.25 It is notable that several issues are not well covered by regular supra-regional assessments, including social and economic changes, habitat changes and broader ecosystem changes. While the Millennium Ecosystem Assessment (MA), Global International Waters Assessment (GIWA) and Large Marine Ecosystems (LME) projects have made critical progress and contributed important information on these topics, there are still major gaps in global coverage.

Findings on assessment processes

3.26 The information collected on assessment processes can be organized into categories that comprise key features of an assessment process. These categories derive from the templates used by the Group of Experts and are further developed in Chapter 4. The findings relate equally to regional and supra-regional assessment processes, based on the assessments of individual assessments and on the regional and supra-regional summaries. They note findings from existing assessment processes including deficiencies. Chapter 4 takes a further step by identifying best practices.

Nature of the organization and its assessment mechanism

3.27 The nature, mandate and character of the organization conducting an assessment has major implications for the assessment process employed. Marine assessments are carried out by regional seas conventions/organizations (see Box 3.2), RFMOs and other regional fishery bodies (RFBs), regional scientific organizations like the International Council for Exploration of the Sea (ICES) and the North Pacific Marine Science Organization (PICES), and pursuant to other global and regional agreements such as the Convention on Migratory Species (CMS). The GEF is engaged in a suite of regional Transboundary Diagnostic Analyses (TDAs) in 16 large marine ecosystems (See Box 4.1). Supra-regional assessments are carried out by intergovernmental processes like the Intergovernmental Panel on Climate Change (IPCC), under global conventions like the International Whaling Convention (IWC) and the London Convention (dumping), and through intergovernmental organizations (IGOs) like the United Nations Environment Programme (UNEP) (e.g., Global Programme of Action for Protection of the Marine Environment from Land-Based Activities, GPA), FAO (e.g., fisheries, mangroves) and the International Maritime Organization (IMO) (e.g., Globallast – risk of invasive species through ballast water). In addition, the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), a UN inter-agency mechanism, has carried out numerous reviews of specific marine sectors and themes. International and regional conservation organizations also conduct assessments, for example the International Union for Conservation of Nature (IUCN) Red List process on conservation status of individual species (www.iucnredlist.org), the World Wild Fund for Nature (WWF) (by-catch of threatened seabirds, sharks and turtles in longline fisheries in the Benguela Current LME (Petersen and others 2007)) and the Nature Conservancy global review of marine invasive species (Molnar and others 2008) and of marine conservation priorities in South America (Chatwin 2007). Formal assessments are supplemented by regional and global status reports, scientific reviews, publication in scholarly journals, atlases and other documents that bring together current knowledge of scientific findings and research. They are supported by several supra-regional data collection/observation programs and databases under the auspices of one or more IGOs,

Box 3.2: **Regional Seas Programme of UNEP**

UNEP's Regional Seas Programme, initiated in 1974, provides a legal, administrative, substantive and financial framework for the implementation of Agenda 21 (UN 1992) (in particular chapter 17 on Oceans), the Plan of Implementation of the World Summit on Sustainable Development (UN 2002) and for the Bali Strategic Plan (UNEP 2004). The Regional Seas Programme aims to address the increasing degradation of the world's oceans, coastal and marine areas, through the conservation and sustainable use of these environments, by engaging member countries to cooperate in comprehensive and specific actions for the protection of their shared marine environment.

The Programme is based on regional Action Plans, which are usually adopted by high-level intergovernmental meetings and implemented, in most cases, within the framework of a legally binding Regional Seas Convention and its specific protocols, under the authority of the respective contracting parties. Each action plan has an environmental assessment component to evaluate the causes of environmental problems and their magnitude and impact and to identify problems that need priority attention in the region. The plans include activities such as baseline studies, research and pollution monitoring, ecosystem studies, studies of coastal and marine activities and social and economic factors that may influence or be influenced by environmental degradation.

Currently seventeen members of the regional seas family are reflected in the AoA regions (See Annex I). Altogether more than 140 countries participate in at least one Regional Seas Action Plan or convention. In 12 of the regions, states have also adopted a legally-binding convention. In recent years the secretariats of the regional seas conventions and action plans have met annually to agree on strategic directions and joint initiatives.

a few non-governmental organizations (NGOs) and several multi-institution partnerships.

3.28 The nature of these processes is extremely varied, including formal intergovernmental bodies with agreed procedures as found in the IPCC and RFMOs, expert group processes with established procedures such as the IUCN Red List process and the structured but flexible approaches used in the TDAs. IGO assessments vary from those undertaken through the formalized inter-agency GESAMP process to those undertaken as "in-house" assessments and reports under the auspices of one or more organizations with less formal rules and procedures. There are also bodies engaged in assessing individual operations (e.g., fisheries, collection for aquaria) to ensure that their practices are sustainable. Most of these processes continue to evolve. (For a summary description of how a number of these processes are organized, see Annex II.)

Establishment of clear objectives and corresponding scope (coverage) for the assessment

3.29 Assessments can be designed to be narrow or broad in thematic or sectoral coverage. The time frames can also vary, either in regard to the period in which data were collected, the frequency of the assessment or the horizon for future projections.

3.30 Many of the assessments reviewed by the Group of Experts had clearly stated objectives. Several employed a clear conceptual framework agreed in advance; for example, GIWA (2005/6), State of the Mediterranean Marine and Coastal Environment (1996), TDAs, European Lifestyles and the Marine Environment (Langmead and others 2007) and GEO-4 (UNEP 2007). Some assessment processes utilized explicit terms of reference (TOR) or a similar document to set out the scope of the assessment, the framework for analysis and, importantly, the specific needs or questions of interest to policy and management authorities (e.g., GESAMP, RFMOs, Arctic Climate Impact Assessment (ACIA), IPCC, MA). In many other cases, however, there was no clear conceptual framework or "roadmap" for achieving assessment objectives nor a clear articulation of the key questions to be answered.

3.31 The Group of Experts was specifically asked to address the extent to which assessments identify the communities, activities and areas most vulnerable[5] to changes in environmental goods and services. This is a topic that would normally be incorporated into the objectives and conceptual framework of an assessment and which may have particular resonance with decision-makers and the public. Examples of this specialized kind of assessment are those focused primarily on vulnerability to the effects of climate change. In the South Pacific the assessment was based on the environmental vulnerability index (EVI) using some 50 indicators (Pacific Islands Applied Geoscience Commission (SOPAC) and UNEP 2005). The GIWA assessment, in addressing the socio-economic impacts of changes in the marine environment off East Africa, examined

5 The concept of vulnerability is important in many different fields of research. In general terms, vulnerability refers to the potential of a system to be harmed by an external stress (threat). In the context of this report, the threat is marine environmental change caused by various pressures, and "vulnerability" means the adaptive capacity or resilience of species, people or the environment to environmental change. It depends on the exposure to change (extent of change and impacts) and the sensitivity and capacity to adapt (resilience).

the effects of coral bleaching on fisheries and tourism in the Indian Ocean as well as the impacts of shoreline change on coastal infrastructure. Vulnerability analysis was also undertaken in the Global Environment Facility (GEF) Guinea Current LME assessments in the West African region, utilizing an adapted GIWA methodology. In the Arctic Climate Impact Assessment (ACIA) the combined effects of changes in climate, UV radiation, economic activities and adaptation strategies were explored. The ICES regional ecosystem study group for the North Sea and the PICES North Pacific ecosystem assessment also identified the vulnerable components of the ecosystem. In the ICES study the associated goods and services and their human uses were also considered.

3.32 Some assessment processes, including many at the global level (e.g., the Global Environment Outlook (GEO), MA, IPCC) include an outlook component in the process that develops and analyses future scenarios. GEO has provided a training manual which covers the development and analysis of scenarios and has made particular efforts to link global and regional scenarios and provide quantitative analyses of likely outcomes.

Policy relevance

3.33 Assessment products and processes relate to decision-making processes and the policy cycle, through:

a. Influence in relation to policy measures;
b. Interaction between experts and policy-makers;
c. Frequency and timeliness in relation to the policy cycle;
d. Identification of priorities; and
e. Evaluation of future policy options and likely outcomes or the effectiveness of past policies.

3.34 Regarding overall *influence of assessment products in relation to policy measures*, about half of the analyses of individual assessments in the GRAMED database reported that the assessment had either some or significant influence, but in view of the wide variety of assessments it is very difficult to generalize on this point. More in-depth examination would be needed as to why and how this influence occurred. The same is true regarding the value or effectiveness of interactions between experts and policy-makers, whether in clearly defining the objectives and questions to be answered in the pre-assessment stage or in ensuring that

policy-makers clearly understand expert findings and evaluations of policy options. Under convention-based processes that involve regular meetings, and a direct relationship between the decision-making body and an assessment or scientific advisory body (e.g., RFMOs, OSPAR Commission, Helsinki Commission (HELCOM)), it can be inferred that such interactions are at least timely and in some cases effective. There is ample time for discussions between experts and decision-makers and when miscommunications occur there are efforts to improve the next iteration. For assessment processes that have no direct link with a decision-making body, no assumptions can be made about timeliness and it may be difficult for experts and policy-makers to connect.

3.35 More generally, the Group of Experts found that many assessments show no clear link between the assessment and policy and management processes. A number of assessments have been produced only once, as opposed to periodically or with regular updating (e.g., GIWA, certain regional seas assessments). In many assessment processes, there is no regular cycle linking monitoring and assessment to measures previously adopted in order to evaluate progress made and the need for further actions. A few notable exceptions include the developments under OSPAR and HELCOM, with respect to land-based pollution in the Mediterranean, as contemplated in the TDA/SAP processes at the regional level and regular RFMO meetings. As for identifying priorities, many assessments evidently do so; however, they often list a series of priorities without an objective basis for policy-makers to understand the *relative* significance of each problem and the various sectoral causes. In addition, when an assessment focuses on a particular sector or species/habitat, priorities are identified within that context but not relative to priorities for other sectors or ecosystem components. With narrow thematic assessments there may not be a strong basis for setting priorities across sectors and/or ecosystem components.

3.36 Only some assessments actually analyze policy options and, even more rarely, their potential outcomes. The coverage also varies substantially. They may focus on one sector or several (e.g., when many sectors contribute to marine debris or habitat degradation) and cover technical options as well as broader

policies like economic incentives or changes in production, managerial or enforcement processes. More often a generic list of "good practices" is used to address concerns that arose in the assessments, such as a list of measures to mitigate seabird by-catch in fisheries or to reduce nutrient pollution from agriculture. Some convention-based and other assessment processes actually specify criteria and approaches to be used in evaluating best practices/technologies or other policies and measures.[6] Such "good practices" have value if they can be related easily to concrete circumstances in different countries and regions. There are other examples where response options are specifically tailored to particular problems in a defined region or sub-region (e.g., TDA/SAP, see Box 4.1), or where they focus on achieving a very specific objective in a given area or region, such as reducing nutrient pollution or sea turtle by-catch by a stated percentage. This direct linkage not only with policy-makers but also between problems and potential solutions, and further analyses of the trade-offs (costs and benefits) among potential solutions, is especially informative for decision-makers. A relatively new tool termed Management Strategy Evaluation, extensively developed in Australia, South Africa, the EU, and Canada, can formally evaluate the risks associated with alternative fisheries management strategies; that is, how robust they are to scientific uncertainties and/or potential failures in policy follow-up (See para. 4.25). Yet another variant is an assessment process that evaluates and certifies individual activities, for example, the Marine Stewardship Council certification procedures for sustainable fisheries (see Annex II).

How non-governmental stakeholders participated in the assessment

3.37 The Group of Experts found various ways in which non-governmental stakeholders may be involved in an official assessment process. In some cases, because they participate as observer organizations in the intergovernmental body calling for the assessment, they can influence decisions regarding the design and

6 Notably, the 1992 Convention on the Protection of the Marine Environment of the Baltic Sea Area (HELCOM Convention), Annexes I, II, III; 1992 Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention), Appendices I and II. In another example, the IPCC (Working Group III) uses four main criteria to evaluate policies, measures and instruments to mitigate climate change: environmental effectiveness, cost effectiveness, distributional effects (including equity) and institutional feasibility (IPCC 2007).

conduct of assessments and how to respond to assessment findings (e.g., OSPAR, HELCOM, some RFMOs). In a few cases, they can nominate experts and/or participate as experts in the actual assessment (e.g., some ICES working groups). Non-governmental stakeholders have also played an effective role in communicating assessment findings (e.g., ACIA, Yellow Sea LME).

Selection of experts

3.38 In the case of intergovernmental processes (e.g., ICES, RFMOs, TDA, the International Whaling Commission (IWC)), the Group of Experts found that governments normally nominate the experts for a scientific advisory or assessment process. The nominations may be from any source a government chooses – national laboratories, academic centers, civil society – and often there are supplementary avenues for other experts to take part or be consulted. In a few cases, agency secretariats in consultation with governments and other appropriate bodies select the experts (e.g., Barcelona Convention, GESAMP). For the ACIA, lead authors were selected by a mixed steering committee (representatives of governments, indigenous peoples' organizations and the International Arctic Science Committee) based on nominations from governments and other organizations. Most processes ensure, implicitly or explicitly, that governments (and others as relevant) nominate recognized experts and, depending on the scope of the assessment, a mix of disciplines, balance of regions and/or gender. Some processes set out additional criteria for selection of experts.[7]

Means for quality assurance

3.39 The Group of Experts consistently found that the most reliable means of quality assurance to expose and eliminate unsubstantiated material – whether data, models, theories, analyses, analytical methods, extrapolations or the use of traditional knowledge or grey literature – is dialogue and debate among experts, provided that the range of expertise and interpretational perspectives is adequate. Such an expert group approach is common in intergovernmental, inter-agency and non-governmental assessment processes. As for methods, a number of respected international

7 For example, GESAMP criteria for inclusion in its pool of experts are: postgraduate degree or equivalent experience in a relevant discipline; recognition and excellence in field of expertise; willingness to declare any conflicts of interest; ability to serve in an independent, individual capacity; and willingness to serve on a voluntary basis (GESAMP 2005).

bodies have been involved in developing widely applied methods for marine environmental monitoring and assessment. The imprimatur of international bodies gives confidence in the reliability of methods applied.

3.40 Typical approaches to data quality in the assessments evaluated include: quality control by institutions supplying the data or quality assurance procedures built into the data collection or processing systems (e.g., HELCOM, OSPAR, ICES, Global Coral Reef Monitoring Network (GCRMN), government agencies), use of public official statistics and adopting a policy of accepting data only from peer-reviewed sources. Information on sea turtle habitat in the Wider Caribbean was subjected to rigorous quality control by tracing each data point, its original source for verification and degree of confidence using expert opinion (Dow and others 2007). In another example, ICES utilizes a supplementary procedure where the secretariat verifies that its quality control procedures for fisheries data collected by member governments have been applied before the data are added to the database.

Availability of data and metadata

3.41 The Group of Experts found that assessment products and the underlying data are usually available but that many assessments apparently do not make metadata available. Certain restrictions are also common. Under RFMOs, data acquired from the fishing industry is normally confidential in order to avoid disclosing information that would benefit competitors. Limitations may also apply when scientists have yet to publish their findings or when the release of traditional and community knowledge is deemed proprietary. A few institutions have rules governing access and use of data (e.g., CCAMLR, OSPAR), an agreed data policy (e.g., International Polar Year) or a data management plan that covers data management, preservation and dissemination, including metadata The FAO's Fishery Resources Monitoring System (FIRMS) is an online, data management system (http://firms.fao.org/firms) that provides access to a wide range of information on the global monitoring and management of marine fishery resources. The institutional partners currently include eleven of the 44 regional fisheries bodies, of which nine are RFMOs. FIRMS provides a good example of the interoperability of distributed data, engagement

of existing bodies and establishment of standards, along with the additional benefits to partners that result from combining data for products such as the FAO report on the State of World Fisheries and Aquaculture (SOFIA).

Interaction among experts and the treatment of lack of consensus

3.42 The Group of Experts found that many assessment processes resolve differences over the science and its interpretation through recourse to further data, peer-reviewed publications or dialogue among experts, including the peer review meetings discussed below. In some cases, explicit procedures have been developed for situations when differences persist, notably in RFMOs. These include requirements that the report of the scientific advisory committee as a general matter include any minority reports provided to the chairperson of the committee; when consensus cannot be achieved, the report should present "all views advanced on the matter under consideration" and that "if a member or group of members in the committee so wishes, additional views of that member or group…on any particular questions may be submitted directly to the [decision-making] commission".[8] The IPCC "Principles" provide for different views of a scientific, technical or socio-economic nature to be recorded upon request.[9]

3.43 In an interesting national example, the science advisory process for fisheries assessments in Canada seeks consensus also on the scope of disagreement. That is, when there are contradictory data, analyses or interpretations, or when the experts disagree about the weight to be given to different parts of the contradictory information, an agreed statement is developed; this describes the evidence that supports and/or conflicts with each option or inferred trend and the risks associated with accepting each option if the evidence presented is shown to be either correct or incorrect.

3.44 Some RFMOs provide for recourse to outside experts not engaged in the assessment process. In one relatively recent example, the Commission for the Conservation of Southern Bluefin Tuna

8 Rules of Procedures of the Scientific Committee of CCAMLR, Rules 3 and 17.

9 Principles Governing IPCC Work, approved at the Fourteenth Session (Vienna, 1-3 October 1998) on 1 October 1998 and amended at the 21st Session (Vienna, 3 and 6-7 November 2003).

(CCSBT), after prolonged controversy over stock assessments, established in 2000 an advisory panel to the scientific committee comprised of external scientists. Its role is to provide views and facilitate consensus in the stock assessment group and the scientific committee as a whole, and to provide the committee and Commission with its own views (Willock and Lack 2006). More generally, an RFMO scientific body may seek the advice of other scientists on an *ad hoc* basis, as required.[10] Under the Western and Central Pacific Fisheries Convention (WCPFC), the commission itself may engage scientific experts to undertake research, analyses and stock assessments and provide advice.

Peer review

3.45 Peer review of assessments appears to be standard practice. It can range from asking a few external experts to review the report or parts of it, to review of working group reports by an established "second-level" committee (e.g., ICES), to review by an independent scientific body (e.g., ICES review of OSPAR products) to a several tier review process such as that of the IPCC (see Annex II). GESAMP employs a two-tier review process of working group reports, first by at least three external scientific experts and at least three representatives of the identified user community. Then the draft report, with a description of the working group's responses to substantive issues raised by reviewers is submitted to the full GESAMP membership for consideration and final approval. In addition, the Group of Experts found many examples of "peer review meetings" where experts from relevant backgrounds engage in a challenge-format meeting to review the content and conclusions of an assessment document.

Means of communicating assessment results to the public

3.46 The Group of Experts found that most assessments were disseminated as reports. These may take several forms, including a summary for policy-makers and the general public and more technical scientific reports and case studies. In limited cases, assessments are published in peer-reviewed journals (See discussion in chapter 4, para. 4.49), which helps reach the

10 Rules of Procedure of the Scientific Committee of CCAMLR, Rule 2. WCPFC Scientific Committee may similarly invite outside scientific experts to participate in its meetings (Art.12.4).

scientific community. There were some examples of other forms of communication, such as policy briefs and fact sheets, press releases, videos (e.g., the Partnership in Environmental Management for the Seas of East Asia (PEMSEA), ACIA), teaching materials, posters and websites (relatively common). In several cases, CDs and websites were used to make available supplemental data and information (e.g., PEMSEA, HELCOM). The use of graphs and charts to convey information and analyses is becoming widespread. Graphics in the form of maps and representations of spatial data were found to be particularly valuable in conveying information, both for technical and non-technical audiences.

3.47 The Group of Experts found several examples of assessment processes that had developed a communications strategy (e.g., ACIA, PEMSEA, YSLME, GEO 4). In some cases targeted meetings were employed to reach certain communities (e.g., Arctic aboriginal communities) and presentations planned for ministerial meetings (e.g., ACIA, GEF South China Sea project) and other conferences and forums (e.g., PEMSEA, HELCOM). In the GEF YSLME project, two parliamentary conferences were held to inform legislators about the project and what they could do to assist in managing marine activities. In other cases scientific journalists have been hired to work with the assessment teams to produce more readable or popular versions of their scientific reports (e.g., GESAMP, ACIA, Arctic Monitoring and Assessment Programme (AMAP)).

3.48 Innovative techniques used to reach a broad audience in the Mediterranean region include a popular journal, *Medwaves*, issued by the secretariat of the Barcelona Convention since 1985; since 2002, a Circle of Mediterranean Parliamentarians and a Circle of Mediterranean Journalists have been used to exchange information and enhance communication with these constituencies on protection and sustainable use of the Mediterranean Sea.

Capacity building

3.49 There is a vast range of initiatives to strengthen human resources and institutional capacity in marine monitoring and assessment, undertaken through cooperative programmes with bilateral and multilateral agencies and in partnerships with NGOs and private industry. Many of these concentrate on data collection and analysis

for such matters as fisheries, pollution, habitat or oceanographic conditions. The use of larger-scale ecosystem approaches, for example the GEF LME initiatives, gives opportunities for broader capacity building through joint priority setting.

3.50 The Group of Experts found that expert networks play a major role in strengthening capacity at the regional level and in some cases between regions (see para. 4.76 and Box 4.4). The exchange of information, knowledge and experience within and, less frequently, between different disciplines benefits participants on an ongoing basis and may encourage the generation of compatible and reliable data. As expert networks develop, their linkage with regional and global policy-making bodies grows, fostering more effective communication between experts and policy-makers. Examples include the networks developed by ICES for over a century, under the Barcelona Convention for more than 30 years and, for more than four decades through the IUCN Species Survival Commission (SSC) to support the Red List process. The Baltic Sea Experiment (BALTEX) provides another example of an international network of scientists with the capability to make important contributions to assessment efforts, in this case for HELCOM.

Post-assessment evaluation of the assessment process

3.51 The Group of Experts found a few examples of assessment *process* evaluations. At the regional level, the OSPAR QSR 2000 was evaluated by the OSPAR Secretariat and the results were utilized in preparing for QSR 2010. HELCOM had a review of its assessment processes and adopted a new strategy in 2005. ICES meets regularly with client commissions to review its work, following which the results are considered by the ICES advisory process and Council. At the supra-regional level, thorough reviews were undertaken of the GESAMP process in 2001 (IMO 2001) and the TDA/SAP process in 2005 (Mee and others 2005), while the Millennium Ecosystem Assessment has been subject to several evaluations.[11] Following extensive review, the

11 These include an independent terminal evaluation initiated by UNEP as part of GEF procedures, completed in September 2006, an evaluation by the United Kingdom Environmental Audit Committee of the House of Commons in 2007 (see UNEP/CBD/COP/9/INF/26 2008) and an analysis submitted by the Institute of Advanced Studies of the United Nations University (UNU-IAS) on the use and impact of sub-global assessments in the MA (see UNEP/CBD/COP/9/INF/20 2008). See also UNEP/CBD/COP/9/13 2008.

revised categories and criteria for the IUCN Red List assessments were put into use in 2001 and new classification schemes for (i) threats and (ii) conservation actions in 2008 (www.iucnredlist.org). Studies of assessment processes are also reported in the academic literature (e.g., Farrell and Jaeger 2005, Mitchell and others 2006, NRC 2007).

DISCUSSION

3.52 The following paragraphs summarize the findings of the Group of Experts' review of existing assessments, both as products and as processes. A number of patterns emerge which provide insight into the available data, expertise and institutional infrastructure comprising the building blocks for the Regular Process.

Coverage and themes in assessments

3.53 Globally, the assessments of living marine resources are generally the strongest, followed by extensive work in water quality assessments. All regions have at least some information on fishery status and trends, although the level of analysis varies and full analytical assessments are only available in a few places. Extensive assessments of species not exploited commercially are much less common and assessments of lower trophic levels, including primary productivity, have been conducted primarily in the seas adjacent to the most developed countries. Likewise assessments of water quality are widespread but assessments of status and trends of physical oceanographic conditions, while common in the North Atlantic and North Pacific are uncommon elsewhere. In relation to land-based activities impacting the marine environment, including water- and airborne impacts, these are covered in many of the land-based pollution assessments; waterborne impacts expressly form part of the GIWA assessments.

3.54 From the regional summaries, clearly there is the capability (technical ability, trained professionals, established data systems) to assess fisheries, as well as water quality status and trends, given sufficient funds to collect basic data and perform the analyses. The various GOOS initiatives are establishing the monitoring programmes needed for more global coverage

of assessments of oceanographic conditions. With regard to assessments of living resources that are not harvested, the types of research surveys needed as data sources for such assessments are increasingly supported but still uncommon outside the Exclusive Economic Zones (EEZs) of the most developed states. Overall, assessment capacity for fisheries and water quality is quite uneven because of inadequate funding and institutional capacity in many parts of the world.

3.55 Both thematically and sectorally, assessment coverage is particularly weak in areas beyond national jurisdictions and integrated assessments beyond EEZs are particularly scarce. RFMOs do conduct assessments that cover their full area of authority, which often extends well beyond EEZs, and this is also the case with a few regional seas programmes (e.g., OSPAR, Barcelona Convention). There are also several major international research programmes that cover extensive open ocean and deep-sea areas. Nonetheless, data are almost always sparser in areas beyond national jurisdictions. Consequently models and analyses are commonly dominated by information from coastal areas or within EEZs, even when results are interpreted much more widely.

3.56 Characterization of habitat and impacts upon it are less well developed globally and have tended to focus on specialized and high-risk environments such as coral reefs, seagrasses and mangroves, marshes and estuaries. The methodology, metrics and framework for habitat assessments are less well developed than for living marine resources and water quality. Habitat is the property that inherently integrates many ecosystem features, including higher and lower trophic level species, water quality, oceanographic conditions and many types of anthropogenic pressures. Thus, strengthening assessments of status and trends in habitat quality and extent will be an important priority in the development of a global marine assessment.

3.57 Protected species such as many marine mammals, seabirds and turtles are extensively assessed only in certain areas, primarily the developed world, while knowledge of their status in developing countries is much more limited. In addition, there are serious data deficiencies on the impacts of fisheries on many non-target species

and these impacts may not be evaluated and reported even though these species may be important components of marine ecosystems.

3.58 Social and economic conditions are quite poorly assessed globally, even in those regions where extensive assessment information is available on the status and trends within the natural environment. In some cases, economic information has been collected but is either not easily available or not analyzed with respect to the values (goods and services) derived from, and impacts on, coastal and marine areas. Even where socio-economic data are available, they are seldom integrated into environmental assessments other than in a very general manner (population density, for example). The Group of Experts found that connections between agencies analysing social and economic data and those assessing marine ecosystems were weak, or in some cases absent. Even when such connections existed integration of the information held by the agencies was not a main objective of either agency (see para. 3.60). These analyses need to be substantially expanded and improved in order to provide a fuller picture of status and trends for marine ecosystems and coastal and other communities.

Integration

3.59 While regional pollution assessments often integrate results across sectors of human activity that may be sources of the pollutants, in other fields this is rarely the case. So even if there are strong fisheries assessments in some regions, there is frequently no linkage to assessments of habitat, water quality or other features. In some cases, there are multi-disciplinary assessments that involve distinct analyses covering more than one component of the ecosystem in parallel. However, there are few interdisciplinary assessments where the work cuts across scientific disciplines, considers interactions among sectors and ecosystem components as well as cumulative effects, and is integrated from the outset. The interdisciplinary methodology for integrated assessment is not well established and this is an important area for further research and development.

3.60 This lack of integration is considered by the Group of Experts to be largely a consequence of the relationship of assessment content and process to the mandates of the institutions calling

for the assessments. At best, institutions with regulatory authority may request assessments of the social and economic status of the drivers they regulate, and the marine resources necessary for the industry or industries they regulate (e.g., the fish stocks targeted by a fishery), and as the ecosystem approach gains acceptance, the broader ecological impacts of the activities. Institutions with mandates to conserve particular components of the ecosystem support assessments of those components and the impacts of various drivers (natural and anthropogenic) and pressures on those components. This linking of assessments to institutional mandates may result in redundancies of coverage in some areas (e.g., where the same ecosystem components and human activities may be assessed by both an RFMO and a biodiversity conservation agency, using different experts and processes, not necessarily using the same data, methods or conclusions). More importantly, the linking of mandates to assessments means that because there are few institutions with a mandate for truly integrated policy and management, there are limited calls for truly integrated assessments, unless there is a mandate from higher levels within government to integrate (e.g., the Barents Sea Management Plan). This gap will not easily be filled without significant governance adjustments at regional and global levels. Consequently, unless or until such adjustments are made, the Regular Process may have to bridge this gap through its own mandate.

Assessment components and products

3.61 The review found fairly broad use of reference points, values and indicators in fisheries, and coherent theoretical bases for setting reference values or points across jurisdictions. It also found wide use of reference points in water quality assessments in the developed world and growing use among developing states. However, there is not yet an agreed global framework for setting reference points reflecting "good" environmental status of water quality. There is a more complete framework for reference points regarding degraded water quality. Other than commercial fish stocks, water quality, and in some cases protected species, most of the assessments considered in the review lacked clear standards for comparing status and trends over time to reference levels. This is a critically important issue for the provision of advice to policy-makers. Without

agreed frameworks for setting reference points for use in evaluating marine ecosystem attributes and goal setting, the establishment of medium and long-term management targets and the comparison of management alternatives will remain problematic.

Analysis of policy options and linkages to decision making

3.62 Assessments should develop products that advise policy-makers but in many regions there was no clear link between scientific assessment and policy and management processes. The ability to make this connection at regional, supra-regional and global levels is especially challenging in view of the wide range of decision-making bodies. Clearly, some assessment processes may generate long term perspectives and prognoses rather than directly inform short-term management decisions. Even in these cases, making sure that results are timely and in a form that is accessible to policy-makers is essential. This is an area that needs particular attention in developing the Regular Process. In some regions, an integrated policy framework is being used to guide ongoing assessment work (e.g., the EU Marine Strategy Framework Directive 2008)[12] that supports an ecosystem approach to managing human activities in the oceans.

Datasets

3.63 There are major gaps in coverage of data on the marine environment globally. For many types of data, sampling is restricted in space and time and consistent time-series datasets are rarely maintained. It is unclear in most cases if these are representative of larger areas of coastal and ocean environments. Determination of representativeness is a major need in the analysis of marine environmental data.

3.64 Another major area of concern is the availability and interoperability of datasets on different aspects of the marine environment. Many datasets do not provide sufficient resolution for integrated analysis of the marine environment because sampling strategies are different. A large amount of work is required before it will be possible to relate datasets on different aspects to one

12 EU 2008. Directive 2008/56/EC of the European Parliament and if the Council of 17 June 2008, establishing a framework for Community action in the field of marine environmental policy (Marine Strategy Framework Directive)

another. Database structures often do not lend themselves to integration across datasets. In some regions, database infrastructure is inadequate to maintain and fully utilize data. For the Regular Process it will be necessary to specifically address global monitoring processes and the role of global institutions in providing coherent and accessible data across regions and for the regions.

Processes

3.65 The Group of Experts found limited awareness of how the design of an assessment process fundamentally influences the quality of its products, how they are perceived (relevance, legitimacy, credibility) and thus the influence of the assessment. Nor is there a systematic approach or "checklist" of what should be addressed and resolved in the "pre-assessment" stage. This includes not only the specific objectives of an assessment but also a framework for relating different aspects to be assessed within the context of the agreed objectives (conceptual framework). A number of procedural and organizational issues should also be considered at the outset; too few assessments address early on how to preserve underlying data and information for future analyses.

3.66 There is growing appreciation of the need for good interaction between policy-makers and experts so that policy needs are clear to the experts in advance and policy-makers gain maximum benefit from the work of the experts and fully understand their findings and recommendations. This makes it essential that the assessment process has direct links with relevant decision-making authorities and that policy-makers participate both in setting objectives and designing the conceptual framework for the assessment.

3.67 Institutional arrangements for assessment processes are quite varied, from the nature of the sponsoring organization(s) to the approaches used in selecting experts. There is no ideal arrangement that fits all circumstances; different arrangements can be used for different purposes and continue to evolve. One clear conclusion emerges, however, and that is the need for balance among expert participants; among disciplines and interpretational perspectives, among experts drawn from different stakeholder groups (governments, the private sector and civil society) and on a geographic and gender basis.

3.68 The Group of Experts found a variety of procedures for quality assurance and peer review and evolving practices for dealing with a lack of consensus among experts. There is a need to better document current procedures as a basis for future improvements.

3.69 As *regular* marine assessments become more common and continue to improve, additional measures will be needed to facilitate the availability and accessibility of data and metadata, to ensure that data coverage is adequate and increasingly comprehensive, and to encourage the design of analytical frameworks appropriate to assessment objectives as well as more integrated approaches.

3.70 Three final conclusions are: the need for a more systematic framework for evaluating assessment processes; the need for all assessments to include a concise, straightforward description of *process* features so that assessment processes and their products can be more easily evaluated in future and the need for every assessment process to provide for post-assessment evaluation.

Assessment capacity

3.71 Information on assessment capacity (infrastructure and personnel) is rarely available directly, so capacity is generally inferred from the coverage of assessment building blocks within regions and for particular themes. Extensive coverage implies relatively high capacity; little coverage implies lower capacity.

3.72 Assessment capacity varies widely across the regions. For some sectors, such as fisheries and water quality, the capability to perform assessments exists in the sense of established methodology and available trained technical staff but capacity may still be severely limited by funding, lack of consistency of data collection programs and inadequate data management infrastructure. In other sectors such as habitat, both capability and infrastructure are less developed. As noted above, the capacity to integrate across both sectors and ecosystem components is limited in part by the lack of a fully developed methodology. For social and economic analyses, there may be trained personnel but the focus on coastal and marine systems has not been extensive except in a few regions. Furthermore, the lack of data and data management infrastructure has restricted the assessment of social and economic conditions in many regions. For fully integrated assessments approaches are

still exploratory, so it will take some time to achieve harmonized capacities even if there are mandates and motivations to do so. Knowledge and capabilities for influential assessment *processes* are limited in many regions and at the global level.

CONCLUSIONS

3.73 Overall, while assessment capacity is strong in many regions, there is a clear need for continued efforts to develop greater expertise and infrastructure around the globe in the technical aspects of marine environmental assessment work.

3.74 There are six major areas that need immediate, concerted and ongoing attention:

a. Ensuring that assessment processes are well designed and clearly link assessment processes and policy-makers (see Chapter 4), conducted to the highest standards, and fully documented by the institutions responsible for assessments;
b. Improving data accessibility and interoperability so that assessments can be extended and scaled up or down within and across regions;
c. Increasing the consistency of selection and use of indicators and reference points to guide the interpretation of status and trends;
d. Developing integrated ecosystem assessments that can inform on the state of systems rather than just individual sectors or ecosystem components and which include social and economic aspects;
e. Strengthening the mandates of institutions to undertake fully integrated assessments; and
f. Strengthening capacity for response assessments that are linked directly to the findings of state, pressure and impact assessments.

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