Assessment of Assessments: Best Practices

4

This Chapter considers three basic elements of an assessment process: a) principles for the establishment and operation of the process as a whole, b) design features for an influential assessment and c) institutional arrangements for organizing an assessment.

For eleven design features, it identifies best practices. For the twelfth design feature, institutional arrangements, three issues of particular significance are highlighted: the boundary between science and policy, stakeholder involvement and linking existing assessment processes. Institutional arrangements for a number of existing assessment processes are summarized in Annex II.

Chapter 4 presents a normative analysis of best practices, building on the analysis and findings of Chapter 3 and with reference to the analytical framework set out in Chapter 2.

INTRODUCTION

4.1 This Chapter builds on the findings of Chapter 3 and provides an analysis of best practices[1] both for the assessment *process* and its *products*. Its purpose is to inform decisions on the establishment and implementation of the Regular Process but the findings also apply to assessment generally. They are equally applicable to the regional, national or local assessments that will be important components of the Regular Process.

4.2 The analysis is based on a combination of practices and approaches identified in existing assessments and several studies of features that make assessments influential and the lessons that have been learned (e.g., Farrell and Jäger 2005; Clark and others 2006; NRC 2007).

4.3 Three basic elements of an assessment process are considered: a) principles for the establishment and operation of the process as

1 "Best practice" refers in this report to influential practices in general and not to one single "best" practice. It is important to be aware of all of the best practices in designing and conducting an assessment process or an assessment, although the practices applied in any given assessment may vary depending on the scope of the assessment, its relationship with decision-making bodies and other matters.

a whole, b) design features for an influential assessment and c) institutional arrangements for organizing an assessment. They are normally addressed, at least in a general manner, in the decision establishing an assessment process. Further details are specified in documents subsequently agreed within the institutional mechanism(s) governing the process. Plans for any particular assessment are initiated and carried out in accordance with the agreed principles and procedures of the process and within the agreed institutional arrangements. The details of each assessment are set out in an agreed Terms of Reference (TOR), implementation plan or other guidance document.

PRINCIPLES FOR ESTABLISHMENT AND OPERATION OF AN ASSESSMENT PROCESS

4.4 The eight principles discussed here are distilled from documents establishing previous assessments at global, regional and national levels. They express a general commitment to ensuring that the necessary attributes of relevance, legitimacy and credibility are realized both in the assessment process and its products (see Chapter 2). For most assessment processes, preliminary documentation gives guidance on how agreed principles should be implemented, while the agreed institutional mechanism(s) oversee their application in accordance with agreed procedures. Specific measures for implementing the principles are found in the following sections on design features and institutional arrangements.

Viewing the oceans as part of the whole Earth system

4.5 This principle is reflected in decisions about the objectives and scope of an assessment that takes into account the multiple and interacting pressures on the oceans, the ecological relationships within ocean systems and the linkages between the oceans and other parts of the Earth system. On a broader canvas, it entails striving to build coherent linkages among marine environmental and other assessments within and across scales. This principle strengthens credibility and relevance.

Regular evaluation of assessment products and the process itself to support adaptive management

4.6 This principle recognizes that review, updating and improvement (iteration) are integral parts of an influential assessment process; they allow new knowledge to be incorporated into future assessments. Regular feedback is essential to the scientific process; projections from an earlier assessment need to be evaluated against actual outcomes as a means of identifying weaknesses in the assessment or monitoring methodology. Regular feedback also provides the basis for an adaptive management approach – that is, evaluating progress and failures in order to update policy measures. This principle is also reflected in periodic evaluation of the assessment process. An iterative process of this kind works to strengthen relevance through timely findings related to decision making, credibility through updated knowledge and methods and, by encouraging evaluation of the process itself, accountability and thus legitimacy. It can also help to strengthen capacity as individuals involved in the process will exchange information and knowledge, even during inter-sessional periods, and benefit from lessons learned.

Use of sound science and the promotion of scientific excellence

4.7 This principle is reflected in the choice of analytical methods, data and information to be used in the assessment, in procedures for data quality assurance and external peer review, and in the standards of excellence and objectivity demanded from experts involved in the process. As assessments are needed for all parts of the ocean, they need to make use of the best *available* information, but where data and analysis are limited they can resort to innovative techniques and approaches based on sound methods while striving continually to enhance knowledge. Also important for this principle are procedures for ensuring clarity with respect to assumptions, uncertainties and risks; gaps in data and knowledge; analytical methods and tools and treatment of dissenting views. The open publication of scientific findings and analyses is a means to expand peer review and thereby verify that the science underlying the assessment is sound.

Regular and proactive analysis to ensure that emerging issues, significant changes and gaps in knowledge are detected at an early stage

4.8 This principle is reflected in provision for *regular* assessments which encourage and provide early warning of emerging issues and growing threats, based on monitoring and observation programmes and other credible knowledge. An assessment process can be designed to encourage proactive analysis of emerging concerns through the use of modeling and other tools to project future developments and trends. When an assessment reveals significant uncertainties it can underscore the need for further research. This principle strengthens credibility and relevance.

Continuous improvement in scientific and assessment capacity

4.9 This principle requires focused efforts to broaden and enhance participation in assessment by integrating capacity building into the assessment process. It involves training to ensure that those in the scientific realm and those in the policy realm can understand each others' needs and limitations as well as initiatives to improve the collection, quality, interpretation, exchange and management of data. A regular assessment process can build and strengthen connections within and between regions, among holders of knowledge and different scientific disciplines, and between experts and policy-makers. This principle strengthens credibility, legitimacy and relevance.

Effective links with policy-makers and other users

4.10 This principle encourages communication and dialogue between groups who may use the assessment to change management approaches, behaviour or policies. It is reflected in assessment products that are user-friendly and targeted at clearly defined audiences to ensure that the messages are clear and accessible to those audiences; the products should also be timely in the context of decision making and clearly explain the significance of the findings and any associated risks. This principle strengthens both relevance and legitimacy.

Inclusiveness with respect to communication and engagement with all stakeholders through appropriate means for their participation

4.11 Adherence to this principle is reflected in how well an assessment provides for representation by, and communication with, all relevant stakeholders throughout the process while also providing for balanced participation by relevant disciplines, sectors and holders of information in the expert work. It strengthens legitimacy, credibility and relevance.

Transparency and accountability for the process and its products

4.12 This principle requires that information regarding the assessment process, its progress, findings, products, data inputs and analyses be made available to the public. It supports external evaluation of the assessment process to encourage feedback and improvement. Where conditions under assessment indicate relatively high levels of risk or uncertainty, greater transparency may be warranted. This principle strengthens legitimacy and credibility.

DESIGN FEATURES FOR AN INFLUENTIAL ASSESSMENT

4.13 Based on an examination of the existing assessment landscape in Chapter 3, other relevant studies and its own analysis, the Group of Experts has identified the following twelve basic considerations, or *design features*, as especially important for the establishment and operation of the Regular Process. The sections below discuss each of these features and are followed by a bulleted list of "best practices" for each apart from the final topic, institutional arrangements. The latter is considered further in Chapter 5.

4.14 The Group of Experts found that all of these features should be addressed in initiating and conducting an assessment. In general, it is better that they be agreed in the pre-assessment stage so that the assessment itself proceeds smoothly and attains its objectives. Some would be decided when an assessment process is established, such as the overall objectives and institutional arrangements needed to govern and guide the process. Others would be agreed within the institutional mechanisms themselves or in planning a particular

assessment. In all cases, once an assessment is launched, its planning and design require careful consideration in order to ensure relevance, legitimacy and credibility.

4.15 The list below is not exhaustive but it covers a number of important features of an assessment. Decisions about one feature may influence decisions about others; the best practices set out in each section may be relevant for more than one design feature.

a. **Objectives and Scope:** clear goals and definitions; progress toward integrated marine assessment and ecosystem approaches and progress toward regular, iterative assessment in support of adaptive management that links potential solutions to identified problems;
b. **The Science/Policy Relationship:** regular dialogue, policy-relevant questions, guidance for priority-setting, identified target audience(s) and the roles of governments and other stakeholders vis-à-vis experts, including government involvement in reviewing assessment products;
c. **Stakeholder Participation:** clear and meaningful modalities for participation by stakeholders;
d. **Nomination and Selection of Experts:** transparent criteria and procedures for selecting lead authors, contributing authors, peer reviewers and other experts; provision for balance and to protect the integrity of the process from inappropriate influence and bias (e.g., from employers, funders or sponsoring bodies);
e. **Data and Information:** agreed procedures for sourcing, quality assurance and the availability and accessibility of underlying data and information including metadata; clear standards for reporting on the extent, representativeness and timeliness of available data and the occurrence of any significant gaps; methods for scaling information up or down and for drawing inferences to reach general conclusions, including implications for assessment findings;
f. **Treatment of Lack of Consensus among Experts:** clear and transparent guidelines for addressing and reporting lack of consensus;
g. **Treatment of Uncertainty:** clear and transparent guidelines for addressing and reporting uncertainty;
h. **Peer Review:** agreed, transparent criteria and procedures; use of reviewers not involved in the assessment;

i. **Effective Communication:** provision to develop a communications and outreach strategy to cover the entire period of the assessment, including appropriate products for each identified target audience;
j. **Capacity Building and Networking:** strategies for improving assessments over time through targeted efforts;
k. **Post-Assessment Evaluation:** provision for post-assessment evaluation of assessment products and the assessment process itself, drawing both on *insiders* involved in the process and *outsiders* not involved in any way; and
l. **Institutional Arrangements:** clear agreement on the composition of institutional mechanisms and relationships between them; clearly articulated responsibilities for management and expert components and for the secretariat; development of a networked "system" of assessment processes.

4.16 Several additional aspects should be considered in the pre-assessment stage. These focus on more operational or pragmatic aspects. This Chapter does not discuss these aspects in detail but some are addressed in the context of the Regular Process in Chapter 5:

- a plan to realize linkages with international research programs and with other contemporary assessment processes for various themes (e.g, climate change, ozone depletion, river basins), including potential collaborating institutions and partners;
- arrangements to catalogue/preserve/maintain/make available data and information (reports, papers, graphics material, spatial data) for use in future assessments through use of metadata, electronic databases and other data and information management systems; and
- an implementation plan – schedule and deadlines for organization of work, drafting, review and production of reports, linked clearly with the budget for the assessment; consideration of how to secure expertise and funding for subsequent stages of assessment, thereby to establish a regular cycle.

Objectives and scope

4.17 The first step in any assessment is the development of clearly defined objectives – to guide the process and provide the basis for evaluating achievements. The second is the creation of a

conceptual framework that provides a coherent map to guide the assessment; this is particularly important for dealing with scale and integration issues. The conceptual framework specifies which parts of the system being assessed will be covered (scope), explains how they are connected and how they will be addressed. It identifies the geographic scale and time period covered by the assessment and how it will address different thematic issues, including socio-economic aspects of human/environment interactions. As the scope is defined, relationships to the scope of other assessments should be explored.[2] This is important firstly to integrate assessments across components of marine ecosystems and, secondly, to incorporate and reflect interactions with other major parts of the Earth system, like climate and atmosphere or inflow from river systems. Clearly, the scope will vary for different types of assessments; there is no *standard* scope. Another important concern is varying temporal scales; that is, some marine processes occur over long cycles and others over shorter timescales and they may have more or less immediate impacts. This needs to be taken into account in designing assessments so that results can be interpreted in a meaningful way.

4.18 Agreement on the objectives, scope and conceptual framework for an assessment has implications for such design features as selection of experts and knowledge sources, use of particular analytical methods and tools, timing and modalities for involvement of governments and other stakeholders, effective communication and provision for post-assessment evaluation. The scope and conceptual framework may also affect perceptions of *legitimacy*, for example, whether or not socio-economic impacts are included; or *relevance*, for example, whether or not they respond to identified needs of decision-makers and other users, analyze response options and include feedback components. Well-defined conceptual frameworks and scope also provide guidance in selecting tools, methods and indicators as well as on the need for further research, data collection and reporting, all of which can enhance the quality and *credibility* of an assessment.

2 The Group of Experts found several examples of constructive linkages – in the North Atlantic between NAFO fish stock assessments and those of ICES and other RFMOs, and between the Arctic, OSPAR and LRTAP pollution monitoring programs; between the IPCC and the Arctic climate assessments; as well as efforts to coordinate assessment initiatives among the different seas of East Asia and with the Mekong River Commission.

Table 4.1: **Example of changes in sea surface temperature on human health, food security, physical security and safety as well as broad socio-economic impacts**

STATE CHANGES	Mediating environmental/ ecosystem impacts	HUMAN WELL-BEING IMPACTS			
		Human health	Food security	Physical security and safety	Socio-economic
Climate change related issues – disturbances to the hydrological regime mainly at the global scale					
⇧ Sea surface temperature	⇔ Trophic structure and food web	⇩ Food safety[1]	⇔ Fishery species distribution[2] ⇩ Aquaculture production[2]		⇩ Profits (loss of product sales)[2]
	⇧ Coral bleaching		⇔ Artisanal fishers[2]	⇩ Coast protection[3]	⇩ Tourism attraction[2]
	⇧ Sea-level rise		⇔ Aquaculture facilities[2]	⇧ Coastal/inland flooding[1]	⇧ Damage to property, infrastructure and agriculture[1]
	⇧ Tropical storm and hurricane frequency and intensity	⇧ Disruption of utility services[1]	⇧ Crop damage[1] ⇧ Aquaculture damage[1]	⇧ Drowning and flood damage[1] ⇩ Coast protection[1]	⇩ Energy production[1] ⇩ Law and order[1] ⇧ Damage to property and infrastructure[1]

Arrows indicate direction of change.

1 – well established, 2 – established but incomplete, 3 – speculative

The colour coding refers to the relevant Millennium Development Goals and Targets (see http://www.un.org/millenniumgoals/)

Green indicates that the issue is related to Millennium Development Goal 7, Target 9

Yellow indicates that the issue is related to Millennium Development Goal 1, Target 2

Orange indicates that the issue is related to Millennium Development Goal 7, Target 10

Pink indicates that the issue is related to Millennium Development Goal 1, Target 1

Source: UNEP 2007

4.19 A commonly used framework for assessments is the drivers-pressures-state-impacts-responses (DPSIR) framework (see Chapter 2). GEO-4 used a variation of this framework showing an overlay of the local, regional and global scale levels. It considered impacts of changes in the marine environment on human health, food security, physical security and safety as well as broad socio-economic impacts. Table 4.1 gives an example for changes of sea surface temperature. Going even further, the European Lifestyles and the Marine Environment project (Langmead and others 2007) examined the links between lifestyles and marine ecosystems in an assessment covering regional seas in Europe. By demonstrating direct links

between human well-being and changes in the marine environment such assessments are more likely to influence changes in policy and human behaviour. The GEF International Waters indicator framework uses a variant of DPSIR that considers process, stress reduction, environmental and socio-economic status.

4.20 Another decision regarding the scope of an assessment is whether or not to include an outlook or scenario component. Scenarios allow an exploration of possible future developments to see whether current policies are robust in the face of plausible future changes or to stimulate dialogue on what might happen if certain strategies are followed. The development and analysis of scenarios benefit from a facilitated participatory process and can use certain tools to quantify parts of the scenarios or just to develop narratives on possible future developments.

Progress toward integrated marine assessment and ecosystem approaches

4.21 Within a particular sector, an assessment can be integrated across different ecosystem components. The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) represents a good example of an ecosystem approach to fisheries assessment and there is some progress toward an ecosystem approach in other Regional Fisheries Management Organizations (RFMOs) (Willock and Lack 2006; Mooney-Seus and Rosenberg 2007). *Integrated* may also refer to integration across sectors; that is, the impacts of multiple sectors on one or more ecosystem component(s). For example, a multi-sectoral (integrated) assessment can address a single ecosystem component (e.g., impacts on a particular species[3]) or it can address multi-sectoral impacts on the ecosystem as a whole (Halpern and others 2007). At a larger scale, ecosystem-based assessments facilitate the *nesting* of smaller ecosystems, such as coral reefs or seagrass beds, within the larger system so that management actions can be taken at different levels (see e.g., Sullivan and Bustamante 1999).

4.22 More comprehensive, ecosystem-based assessments can provide a basis for decision-makers to understand and identify the most

3 These are commonly undertaken as a precursor to selecting recovery measures for species considered endangered or threatened.

influential linkages, set priorities and evaluate trade-offs across sectors and ecosystem components. In this way provision can be made for long-term conservation and sustainable use of marine ecosystems. Integrated ecosystem assessments using the same conceptual framework afford the potential for aggregation to larger regional and supra-regional scales. An ecosystem approach to assessment benefits from systematic biogeographic classification of marine areas (see, for example, the Global Open Oceans and Deep Seabed (GOODS) supra-regional summary, Annex V). This provides a framework for identifying and assessing key ecosystem components as well as linkages at different scales.

4.23 The transboundary diagnostic analyses (TDAs) undertaken in the context of the Global Environment Facility's (GEF) International Waters projects (Box 4.1) are examples of progress toward more comprehensive, ecosystem-based assessments. Others occur in European regional seas such as the OSPAR Commission (OSPAR) and Helsinki Commission (HELCOM) processes in the North East Atlantic and Baltic Sea. For example, the early OSPAR *quality status reports* (QSRs) – first produced for the North Sea in the 1980s – focused heavily on marine pollution. QSR 2000 extended coverage to the status and impacts of fisheries in the region. Consequently, governments requested that the International Council for Exploration of the Sea (ICES), the body responsible for scientific advice on these issues in the North Atlantic, ensure that its advice integrated analyses of fisheries and environmental concerns. QSR 2010 will cover fisheries and shipping in addition to OSPAR's five core thematic strategies (biodiversity and ecosystems, eutrophication, hazardous substances, offshore oil and gas and radioactive substances). Both in the OSPAR and HELCOM processes and at national level in Norway (Barents Sea) and Canada, there are ongoing processes to establish ecological or environmental quality objectives (EQOs) for large areas, based on a comprehensive assessment of conditions, trends and human impacts. These objectives will form the basis for integrated management of human activities in these areas.

Progress toward regular, iterative assessment in support of adaptive management

4.24 In addition to updating knowledge and assessment methods, the rationale for *regular* assessment is to provide feedback on the efficacy of measures previously adopted. The need for new or revised measures can then be evaluated and any management gaps can be identified and addressed. Such evaluations encompass (i) how well measures taken in the past have met their stated objectives (policy effectiveness), including any constraints involved and (ii) options for future response measures. This direct linkage between problems and solutions enhances relevance for decision-makers, as considered further below. The extent to which an assessment will address policy effectiveness and future options would normally be specified in its objectives and conceptual framework.

4.25 In the case of OSPAR, the decision-making Commission has agreed on a monitoring and assessment strategy that establishes a clear progression from the rationale for monitoring and data collection to assessment and decision making. QSR 2010 will focus primarily on the delivery of OSPAR's five core strategies; it will evaluate "the effectiveness and adequacy of the measures taken and planned for the protection of the marine environment."[4] HELCOM has a similar strategy, and in this case regular review is enhanced by the use of a website with annually or biannually updated indicators associated with EQOs (e.g., Backer 2008). Likewise, in the Mediterranean there has been progress towards a regular cycle of problem assessment, progress evaluation and proposals for further action at regional and/or national levels, specifically in relation to land-based pollution and endangered species. The Marine Strategy Framework Directive of the European Union agreed in 2008 provides a coordinated framework within which member states are required to assess the state of their marine waters as an element of their marine strategies; these strategies will be regularly updated, hence allowing adaptive management. Moreover, implementation of the Directive will be undertaken by states in the context of the regional seas conventions in which they participate. The GEF International Waters project in the South China Sea, Gulf of Thailand and Yellow Sea Large Marine Ecosystems (LMEs) also demonstrate a strong link

4 Agreement on the Production of the QSR 2010 ((JAMP Product AA-2) (Reference number: 2006-2).

between assessment (status and trends) of the marine environment, the evaluation of options for future policies and actions, and the further development of national and regional action plans to reverse adverse conditions (See Box 4.1).

Box 4.1: **The application of the Transboundary Diagnostic Analysis/Strategic Action Programmes (TDA/SAP) process at the scale of large marine ecosystems**[5]

The TDA/SAP process is applied in the projects of the International Waters Programme of the Global Environment Facility (GEF) to diagnose transboundary freshwater and marine environmental problems and develop a coherent response to them. In 1995 the GEF Council included the concept of Large Marine Ecosystems (LMEs) in its operational strategy as a means of promoting ecosystem-based management of coastal and marine resources. Currently, there are some 16 LME projects involving more than 100 countries in Asia, Africa, Latin America and Europe (See Annex V, "LMEs Global Assessments".)

A number of elements of the TDA/SAP process contribute to, and reflect best practices in, marine assessment. These include:

- progress toward integrated assessments that support an ecosystem approach to managing different sectors of human activity, including recognition of the links between coastal areas and freshwater systems and the effects of changing climate on water systems;
- emphasis on priority-setting for transboundary environmental concerns, based on the identification and quantification of problems within a defined, ecosystem-based geographic context;
- causal chain analysis that allows complex transboundary concerns to be broken down into smaller, more manageable components for action based on identification of each problem and the sector(s) causing it; examination of more fundamental socio-economic and institutional issues;
- utilizing the TDA as the factual, scientific basis for the formulation of the SAP, ensuring that an objective, jointly developed scientific assessment underpins the policy and management decisions considered in the development of the regional SAP;
- an adaptive management strategy where feedback mechanisms review progress, based on indicators associated with agreed objectives and targets, and any new scientific information, leading to periodic adjustments in management and operational objectives;

5 For further information on the GEF LME projects and TDA/SAPs, see www.gef.org, Teng 2006, Mee and others 2005 and Sherman and Hempel 2008.

Box 4.1. **The application of the Transboundary Diagnostic Analysis/Strategic Action Programmes (TDA/SAP) process at the scale of large marine ecosystems**[5] *continued*

- ❑ engagement of stakeholders through joint fact finding and in the development of the SAP;
- ❑ a direct link with government policy-makers;
- ❑ capacity building through stakeholder engagement and other initiatives that strengthen scientific and technical expertise and infrastructure; mobilizing specialist networks within each project and through evolving networks that connect specialists participating in the different GEF IW projects;[6] and
- ❑ monitoring and evaluation procedures that measure the effectiveness of the outcomes of the TDA/SAP process and of the process itself.

The TDA/SAP processes are noteworthy in promoting international collaboration in dealing with shared problems and inter-ministerial collaboration at the national level. The indicator approach noted above is organized within five modules – productivity, pollution and ecosystem health, fish and fisheries, socio-economic aspects and governance. (This is discussed further in Annex V)

4.26 An interesting and relatively new tool, applied increasingly in assessments related to fisheries management (e.g., by ICES and various states including Australia, South Africa and Canada) is the use of management strategy evaluations (MSEs) (see, for example, Smith and others 2007). This approach formally evaluates the risks associated with alternative management strategies. MSE includes consideration of how robust the strategies are in relation to uncertainty in data sources, the relationships among ecosystem components and impacts of fishing, future environmental states that cannot be predicted fully and potential errors of implementation or non-compliance. The MSE also commonly evaluates the effectiveness of past policies in achieving specific fisheries management objectives.

Best Practices on objectives and scope

4.27 The Group of Experts concluded that the best practices are:
A *regular* cycle that closely links feedback from monitoring and

6 For example, an electronic network organized by the American Fisheries Society with a GEF grant links fisheries scientists and marine specialists from some 40 participating countries (www.fisheries.org/afs/international_gfemn.html#1, from Sherman and others 2007).

assessment with a decision-making process or processes designed to review and update policies and measures. The assessment should use a conceptual framework that provides for:

a. Constructive linkages between assessments at different geographical scales (local, regional, global) and temporal scales (long term and short term) and between marine and other assessment processes;
b. Examining not only (i) the state of the marine environment, and its causes (human and natural pressures) and impacts, but also (ii) impacts on human well-being, including the costs and benefits of changes in ecosystem goods and services;
c. Assessing the relative importance of observed pressures on marine environmental goods and services as a basis for decision-makers to assign priorities among them;
d. Assessing response options for identified problems, including associated risks and likely outcomes, the effectiveness of past policies and the costs of inaction;
e. Identifying groups and areas most vulnerable to changes in marine environmental goods and services;
f. Integrated ecosystem assessments including possibilities for setting precise environmental targets using indicators for evaluating progress and facilitating integrated management of human activities;
g. Tracking of indicators on a website (e.g., HELCOM as noted in para. 4.25);
h. Including an outlook component in the assessment based on a participatory process that involves scenario analysis using an established procedure.

The science/policy relationship

4.28 By definition, an assessment is carried out at the interface between science and policy (or between *knowledge* and *action*) (Farrell and others 2001). Given that a primary role of assessment (as defined in this report) is to inform policy decisions, it is important to take into account the needs of policy-makers. In most assessment processes, especially those linked directly to decision-making bodies, there is *boundary negotiation* between the science and policy communities so that the expectations of policy-makers and the ability of the experts to provide the analyses sought are clear

(Cash and others 2003). For assessments that are not directly linked to a client decision-making process, it is even more important to identify the key policies and relevant decision-making bodies that the assessment is intended to influence, as well as external factors such as the priority given to the issues under consideration by the policy community and the general public. In addition to a *direct* link with decision making to enhance policy relevance, *regular* assessment supports adaptive management responsive to new scientific knowledge and other developments – the makings of an iterative assessment process. It has also been demonstrated that when assessments identify and analyze potential "solutions" to the "problems" identified, they are more policy relevant and thus have more influence on decision-makers (e.g., HELCOM).

4.29 To improve potential for policy-relevant assessments, interaction between experts and decision-makers should include consideration of the objectives and scope of the assessment, including the extent to which future response options and/or the effectiveness of past policies are to be evaluated. Other considerations include the time frames for policy development and assessment updates; the constraints of data availability, methods and understanding in meeting policy-makers expectations; effective means and products to communicate findings to policy-makers and other users; and the need to evaluate assessment products and the process itself to enhance policy relevance in the future. Several factors that are especially important in this respect are discussed below.

Regular dialogue between policy-makers and the assessment team

4.30 Regular dialogue between policy-makers and those leading an assessment helps decision-makers shape their requests in the knowledge of what experts can deliver, increasing the likelihood that the assessment will meet their expectations. Once findings emerge, dialogue affords opportunities for policy-makers to fully understand them, clarify assumptions and uncertainties and grasp the implications of the findings for decisions. It can also lead to a clear articulation of questions that require further analysis, which decision-makers can refer back to the expert body (Kimball 1996). For the experts, regular dialogue helps clarify the questions faced by decision-makers and the types of data and analysis needed to address them, as well

as how to characterize and present findings more effectively. The CCAMLR process, for example, has taken explicit steps to enhance a constructive dialogue.[7] In the context of ICES, the Council interacts well with management bodies in providing fisheries advice although it has been recognized that improved dialogue between ICES, OSPAR and other client organizations would assist experts and decision-makers in understanding more clearly what is needed and possible.[8] Where no direct link exists between decision-makers and experts, it is more difficult to ensure adequate dialogue between them.

Explicit terms of reference (TOR) and policy-relevant questions

4.31 Explicit terms of reference (TORs) as well as policy-relevant questions, agreed in the pre-assessment stage, should clearly define the objectives and scope of an assessment and how it will respond to the needs of policy-makers and management authorities. It is important that TORs indicate the degree of specificity sought in relation to particular sectors, impacts, response options and other matters.[9] As noted above, an assessment that expressly links potential solutions (response options) with the problems identified is useful for policy-makers. Analysis of the likely outcomes and risks of each option, or of any impediments found in implementing and enforcing past policies, provides more substantial guidance.

7 For example, the report of the CCAMLR Scientific Committee is required to summarize discussions by the Committee and to include the rationale for all findings and recommendations. Its rules insist on rigorous presentation of scientific advice, with all its associated assumptions, uncertainties and areas of disagreement. Regarding its "influence", the Commission is to "take full account of the recommendations and advice of the SC" (CCAMLR, Art. IX.4).

8 ICES has made a number of revisions to its procedures in attempts to strengthen the link between science and the advice needed by decision-makers. This includes plans and strategies for coordinated research to meet both science and advisory needs; and effective communication of research findings in its advisory work both at the strategic level (i.e., consideration of new options for addressing a problem) and at the operative or tactical level (adjustments to ongoing management measures, such as revising catch quotas or emissions standards) (ICES Council, Dec. 2006). The single biggest change ICES has made is the integration of the three advisory committees into one, with advice (on the basis of regular telecommunications and meetings) provided three to four times a year rather than once a year from each of three advisory bodies.

9 TORs have been employed at the national level, within some RFMOs, by GESAMP and in major assessment processes like the Intergovernmental Panel on Climate Change (IPCC), Millennium Ecosystem Assessment (MA) and Arctic Climate Impact Assessment (ACIA). For example, the scope and outline of the synthesis report of the Fourth IPCC Assessment, which addressed five main topics of interest to policy-makers, was developed by the IPCC bureau and the core writing team and review editors. Policy-relevant questions were approved by the Panel. A core set of questions was also developed for the MA, through discussions and interaction with potential users i.e., representatives of governments, intergovernmental organizations (IGOs), the private sector and civil society.

Guidance for setting priorities

4.32 Developing guidance for policy-makers to set priorities is a very important function of assessment, whether the assessment concentrates on a single sector (e.g., offshore oil and gas, agriculture), problem (e.g, eutrophication, invasive species) or ecosystem component (e.g, fish stocks, essential habitats) or covers the full range of pressures and impacts in a marine area. Policy relevance is enhanced when an assessment explains fully the *relative* significance of different changes in environmental conditions – in both environmental and socio-economic terms. An integrated assessment provides a stronger basis for decision-makers to rank the severity of environmental problems and set priorities across sectors and ecosystem components. If it incorporates social and economic costs and benefits (such as impacts on human health or food security, or reduced employment and revenue as tourism declines), as well as costs of environmental degradation, it can provide additional guidance for decision-makers when establishing priorities and evaluating trade-offs.[10]

Targeting identified audiences

4.33 Reaching each identified target audience requires a clear understanding of which users, managers and specialized decision-making authorities will be affected by an assessment. This is important not only to deliver a useful (relevant) message through targeted products and presentations but also to engage audiences so that they help develop, and then support and apply, the policy options derived from the assessment (NRC 2007). In the marine realm, the audience varies from specialists in shipping, fisheries, marine pollution and conservation, to less specialized officials with a broader range of marine or environmental responsibilities.[11]

10 An evaluation of the MA concluded that its impact on policy and decision-making might have been greater had it been able to convincingly define the economic values of ecosystem services presented in the assessment (UNEP/CBD/COP/9/INF/26 2008).

11 The marine policy realm is characterized by numerous regional and global decision-making bodies with both specialized and general mandates. Specialized global and regional bodies include the International Maritime Organization (IMO), International Seabed Authority (ISA), RFMOs, and regional agreements under the Convention on Migratory Species (CMS). Those focusing on a wider range of ocean concerns include the UN Open-ended Informal Consultative Process on Oceans and the Law of the Sea (UNICPOLOS) and the Regional Seas organizations. Other global and regional bodies include ocean issues as part of a wider mandate, such as the UN General Assembly, Convention on Biological Diversity (CBD), Governing Council of UNEP and others.

Moreover, politicians and senior government officials and their equivalents in the private sector, non-governmental organizations (NGOs), intergovernmental organizations (IGOs) and other stakeholder groups may require a different level of detail than mid-level managers, staff or marine operators.

4.34 The larger the geographic scale and more comprehensive the thematic scope of an assessment, the easier it is to identify linkages across sectors, ecosystem components and regions. But this also poses the challenge of ensuring that assessment products are sufficiently specific to meet the needs of sectoral management authorities at national and international levels and of those operating within the sector. For example, it is important to examine individually the various sources of land-based pollution, and their relative importance at regional and national scales, in order to help decision-makers set priorities and develop sectoral responses. Similarly, it is important to determine the source and dispersal pathway of an invasive species in order to develop a targeted response. As another example, studies have found that special efforts are required to ensure that large-scale assessments of sea level rise are meaningful to coastal zone managers and researchers at the operational level. This can be accomplished (Long Martello and Iles 2005) through links to the operational networks of these specialists or by assessment products specifically designed to address their needs (e.g., changes in historical erosion rates that might require changes in coastal zone setback requirements). On the matter of scale, a large-scale or global overview may lose relevance for particular regions faced with differing concerns and priorities. Even a regional assessment may fail to capture the special situation and thus the attention of a particular sub-group, for example the island nations and territories within the larger Asia-Pacific region. For both large-scale and emerging issues it has been shown that regional and sub-regional assessments can enhance relevance for policy-makers.

4.35 The North Sea provides an early example of how an assessment across sectors can help both in targeting relevant decision-making bodies and in helping them to set priorities. During the 1980s, growing water quality problems led to assessments focusing heavily on marine pollution. As different ministries and international bodies were responsible for different sources of

marine pollution, a triennial ministerial conference was convened to consider assessment findings. This led to agreement on priorities and recommendations to the different regional decision-making bodies (conventions) responsible for ocean dumping, land-based pollution, airborne pollution and river basin management. Through their own specialized advisory processes, these bodies could then target pollution control objectives within their mandates and identify appropriate response measures. Agreement on priorities also allowed governments to justify expenditures when faced with competing claims on scarce financial resources (Kimball 1996). By 1992, growing evidence of environmental problems, among other factors, led to the adoption of a new regional agreement of broader scope (1992 OSPAR Convention) which merged the previous conventions on dumping and land-based pollution. Coordination continues with other regional conventions to monitor and assess river-borne and airborne pollution of the marine environment. The GEF International Waters projects utilize another approach to priority-setting which can be translated into specialized goals and measures for managing different sectors and activities (see Box 4.1).

Boundary between science and policy: the role of governments (and other stakeholders) vis-à-vis experts

4.36 The forgoing discussion underscores the importance of dialogue and interaction throughout an assessment between decision-makers and expert assessors to improve policy relevance. At the same time, it is critical to maintain a clear distinction between the role of the experts and the role of governments and others with a stake in the outcome of an assessment (for example, industry, non-governmental organizations, or sponsoring or funding institutions). Tensions occur when those requesting an assessment define its scope so narrowly that the experts feel constrained in considering relevant information or certain response options that may have great merit.[12] Once decision-makers and other stakeholders have agreed the objectives and scope of an assessment, the experts should be free to conduct their work without inappropriate interference or efforts

12 For example, CCAMLR provides that the Scientific Committee may transmit assessments, analyses, reports and recommendations to the decision-making Commission on its own initiative regarding measures and research to implement the objectives of the Convention (Art. XV). Similarly, the ICES advisory body may provide unsolicited advice when it deems it pertinent.

to modify their evaluations. Conversely, experts should be guided by the requests from decision-makers and refrain from redefining an assessment's scope so that it may be more interesting to them but of less value to the decision-makers.

4.37 Equally important, it is the role of experts to evaluate response options, their risks and likely outcomes, while decisions about what risks to tolerate and how to manage them fall to the responsible decision-making authorities. After the experts have completed their work, governments and other stakeholders have a role in the review and acceptance of assessment products, in particular to ensure the relevance of the assessment and the commitment of the policy community to taking action. Their role is not, however, to modify the expert evaluations. The means for preserving these distinct roles, and the integrity of an assessment process, should be embodied within the associated institutional arrangements.

4.38 A number of models demonstrate the respective roles of decision-makers and experts (See Annex II). For many treaty-based marine assessment processes (e.g, RFMOs, ICES), different working groups with a range of disciplinary expertise produce draft reports which are then reviewed by a committee of experts nominated by each member government who serve in an expert capacity (complemented, in some cases, by additional experts not associated with a member government). This body agrees and transmits a final scientific report, which may include recommendations, to the intergovernmental decision-making body. The role of the latter is not to modify the report; rather, its role is to consider the report's findings and its implications for management and policy decisions. These distinct roles have evolved into an effective means of ensuring the credibility of scientific analysis and insulating scientific advice from inappropriate interference.

4.39 In another model, the Intergovernmental Panel on Climate Change (IPCC) provides for a substantial governmental role in the review and acceptance of assessment products as well as in the initial scoping and selection of experts.[13] There is a good deal of literature on how this process has worked including an

13 The IPCC is currently starting to outline its Fifth Assessment Report (AR5) which will be finalized in 2014. As has been the case in the past, the outline of the AR5 will be developed through a scoping process which involves climate change experts from all relevant disciplines and users of IPCC reports, in particular representatives from governments. (see www.ipcc.org)

early analysis by Agrawala (1998) which discusses the "line-by-line" governmental approval process for the IPCC Summary for Policymakers. In the production of OSPAR's QSR 2010, governments will play a stronger role than before in shaping the process and reviewing drafts (see Annex II).

4.40 The model employed by the Arctic Climate Impact Assessment (ACIA) is especially interesting as it draws on lessons learned about global change assessments. Policy-makers helped frame the questions and scope of the assessment but the scientists had full responsibility for the scientific reports and conclusions. The preparation of a separate policy document with recommendations, based on the scientific reports, was the responsibility of the Arctic Council's intergovernmental working groups, AMAP (Arctic Monitoring and Assessment Programme) and CAFF (Conservation of Arctic Flora and Fauna). The scientists could contribute to and review the policy draft to ensure its scientific accuracy. The policy recommendations were then negotiated by representatives of governments and the Permanent Participants (see Box 4.3) in consultation with the scientists, but the scientists did not have a final say over these recommendations. The clear separation of scientific and technical functions from policy and decision making in the preparation of TDAs and SAPs also appears effective (see Annex II).

Best Practices on the science/policy relationship

4.41 The Group of Experts concluded that the best practices are:

a. A *regular* cycle that closely links feedback from monitoring and assessment with a decision-making process or processes to review, update and implement policies and measures (see para. 4.27);
b. Define the most important target audience(s) for each assessment at the outset, including relevant national authorities and intergovernmental decision-making bodies as well as design products useful to each at the appropriate geographic scales (NRC 2007);
c. Identify decision-makers, sectoral users and researchers who are most likely to use the assessment findings and ensure a forum for interaction and dialogue with the assessment team throughout the process;
d. Develop explicit TORs for an assessment that define its objectives, scope and key questions of interest to policy-makers

and other target audiences in consultation with these and other stakeholders;

e. Encourage those conducting the assessment to report the rationale for all findings and recommendations and to present scientific advice with all its associated assumptions, uncertainties and areas of disagreement;
f. Encourage those conducting the assessment to report the relative risks (for example, of pressures and activities) and vulnerabilities (for example, of society, ecosystem components) whether the risks are assessed formally or not;
g. Encourage those conducting the assessment to highlight the implications of any information gaps for assessment findings and recommendations;
h. Encourage integrated ecosystem assessments as a basis for decision-makers to set priorities across sectors and ecosystem components;
i. Encourage assessments that adequately cover the costs and benefits of changes in ecosystem goods and services to clarify effects on human society;
j. Evaluate response options for identified problems, including likely outcomes, and use scenarios to estimate the risks associated with each option and the costs of inaction;
k. Incorporate small-scale and/or sectoral case studies into the design of large-scale assessments to illustrate implications for specific decision-making authorities or sectors;
l. Encourage decision-making bodies that requested an assessment to indicate how their decisions were influenced by the assessment's findings and recommendations; where expert advice was not followed, encourage these bodies to explain and publicize the reasons (RIIA 2007).

Boundary between science and policy

m. Ensure strong links between the assessment process and relevant decision-making bodies especially at regional and global levels;
n. Establish a clear separation between scientific and technical functions on the one hand and decision-making functions on the other, while ensuring adequate dialogue between them to avoid misunderstandings;

o. Provide in the mandate of the assessment process that an intergovernmental decision-making body cannot modify the expert evaluations of scientists;

p. Provide that when governments do have a role in reviewing/modifying draft reports, the scientists have the final word with respect to the accuracy and completeness of the factual analyses (NRC 2007);

q. Provide that expert groups involved in an assessment can transmit analyses and advice on their own initiative on issues relevant to policy objectives, without a specific request from the decision-making body.

Stakeholder participation

4.42 The geographic and thematic scope of an assessment will influence participation in the process. In general, however, evaluations of assessment processes have concluded that when input is sought from groups with a stake in the outcome, or when experts nominated by these groups take part in an assessment, the groups are more likely to reflect assessment findings in their decisions and activities (van de Kerkhof 2006; van de Kerkhof and Wieczorek 2005). At all scales, stakeholder participation may yield significant benefits (Box 4.2). Careful consideration of which stakeholders to involve in the process, how to involve them in a meaningful way, and at which stages, is fundamentally important in planning an assessment (Jäger and Farrell 2005). At the same time, it should be noted that expanding stakeholder participation may involve trade-offs, as considered in paragraph 2.11. It may lead to increased polarization and/or to lower common denominator outcomes. Furthermore, any process should ensure mutual respect among all participants, who should be encouraged to take a broad view of the issues at stake, bearing in mind the principle of considering the planet as a whole. In some circumstances this may entail special means and incentives for them to participate. Stakeholder participation strengthens credibility, legitimacy and relevance. If it is not well thought out, this may undermine the goals and influence of an assessment.

Box 4.2: **Benefits of stakeholder participation**

- ❑ fosters shared understanding about the objectives and process of an assessment;
- ❑ builds trust between governments and among all stakeholders and minimizes conflicts of use;
- ❑ incorporates different disciplines and expertise and draws on a wide range of expert sources and interpretational perspectives;
- ❑ promotes information sharing and networking, thus strengthening knowledge and capacity and potentially narrowing areas of disagreement;
- ❑ fosters agreement on criteria and methods to be employed in analysis, particularly to address areas of uncertainty;
- ❑ generates full and open discussion, sharpening conclusions and avoiding unsupported opinions;
- ❑ engages participants in the process (ownership), thus broadening interest in assessment findings and their implications, in developing and implementing an effective response and in the effectiveness of measures adopted;
- ❑ promotes a culture of responsibility among all participants;
- ❑ leads to wider awareness and distribution of findings through stakeholder networks.

Ways to involve stakeholders

4.43 Stakeholders can be involved in an assessment process in several ways and at different stages. The assessment management mechanism would normally be charged with providing for such participation. Those who study assessments have made a distinction between *scientific credibility* and *legitimacy*, noting that legitimacy concerns the level of trust all stakeholders are willing to place in an assessment, whereas scientific credibility depends on trust by experts based on the means they use to evaluate all expert analyses (NRC 2007). Bearing in mind this distinction, the following emphasizes that expert participation is only one of several ways to involve stakeholders in the process. (For participation as experts, see paras. 4.45–4.47). Stakeholders may:

a. Provide input regarding the objectives and scope of an assessment as well as organizational matters such as the review process or selection criteria for experts. This allows them to help frame the issues and questions to be considered in the assessment, to identify target audiences and so forth;[14]

14 This may occur routinely when, for example, non-governmental stakeholders participate as observer organizations in the intergovernmental body calling for the assessment. It also occurs when stakeholders sit on the "management" mechanism for an assessment process.

Box 4.3: **Traditional and community knowledge**

Special arrangements may be necessary in an assessment process to ensure participation and contributions from holders of traditional or local knowledge, including individuals from small, often isolated coastal communities. *Why and how* to involve these stakeholders is considered here, while para. 4.52 addresses procedures for quality assurance when such knowledge is included in an assessment. Specialists in the fields of ethno-science and socio-biology also use established methods to bring traditional knowledge (TK) into assessment processes (see for example, Inglis 1993).

By supplementing scientific data and information, local expert knowledge can add depth to an assessment and improve its credibility and legitimacy in the eyes of traditional communities. It can also increase the relevance of an assessment by incorporating knowledge of, for example, key local issues, possible response options and their likely success. Traditional knowledge may be the *only* source of information in some cases, especially of historical knowledge, and in many cases it can serve to correct baselines established by more recently collected data.

Pursuant to legislation enacted in Brazil in 1989, a co-management process between government and traditional resource users has been established for marine extractive reserves (Resex). The purpose is to protect common property resources upon which small-scale fishers depend. Traditional resource users determine which areas should be established as reserves and provide knowledge about local ecology, their own systems for resource conservation and management and the social and cultural context. Following assessments of pressures and the status of resources, a co-management plan is developed, also with participation by local communities, which is then approved by the government of Brazil in order to assure a legal framework for local rights (Di Ciommo and others 2007; da Silva 2004).

In the Canadian Arctic, where extensive use was made of TK in an ecosystem overview assessment, experts in TK helped oversee the assessment process and professional social scientists were contracted by the government to collect it, using methods for testing reliability and ethical standards approved by professional societies. In other regions, special efforts were made to contact TK experts, who met with community residents and users of marine resources to consider TK. In the Arctic, special efforts were made to present draft findings at several stages to aboriginal communities. The final draft was presented to all major aboriginal communities to inform community leaders of the results, receive feedback and adapt the report as needed. This allowed the communities to peer review the use of the TK they had contributed.

Box 4.3: **Traditional and community knowledge** *continued*

Provisions also exist at the international level to enhance participation by holders of TK in international assessment (and management) processes. In the Arctic Council, a high-level inter-governmental forum, indigenous peoples' organizations have special standing as Permanent Participants (PPs), supplementing the governments. They have played a key role in assessments conducted under the auspices of the Arctic Council, notably the Arctic Climate Impact Assessment (ACIA). Representatives of the PP organizations served as an important link between indigenous communities and scientists. They participated as members of the ACIA steering committee, nominated experts and authors who took part in the assessment itself and provided comments on draft reports. PP representatives also participated in negotiations over the subsequent policy document (see para 4.40). Indigenous perspectives brought new information where science had no observations and valuable insights to supplement conventional scientific analyses; they helped confirm scientific observations and were important for understanding the significance of ACIA findings.

b. Nominate experts to a pool from which working group members and peer reviewers will be drawn;
c. Provide data and information to experts to inform their work;
d. Contribute knowledge and expertise. In this respect, they can:
   i. participate as experts[15] in working groups, including as lead or contributing authors; and
   ii. participate as expert reviewers of assessment products;
e. Take part in an external review of draft products along with governments, supplementing expert peer review;
f. Help communicate and evaluate the findings and implications of assessments, including how to respond to them, through conferences, workshops and other means;
g. Help design and participate in review and evaluation of the assessment process and products in order to improve future assessments.

15 This may occur routinely when, for example, non-governmental stakeholders participate as observer organizations in the intergovernmental body calling for the assessment. It also occurs when stakeholders sit on the "management" mechanism for an assessment process.

Best Practices on stakeholder participation

4.44 The Group of Experts concluded that the best practices are:

a. Clear agreement during the planning stages of an assessment on the stakeholders to be involved and how to involve them, including the option of participating as expert assessors;
b. Balanced expert participation in the assessment itself;
c. Documenting in the assessment report how stakeholders were involved in the process.

Nomination and selection of experts

4.45 Stakeholders may be involved in an assessment in several ways, as described above. When they participate as experts, the assessment process should require that they do indeed participate in their expert capacity, bringing their knowledge and expertise to bear; they should not *represent* any interests in a partisan or advocacy manner. Experts may be drawn from governments, IGOs, NGOs, academic and research institutions, the private sector and holders of traditional or local knowledge. No candidates should be excluded solely on the basis of the institutions that employ them. The choice of experts for an assessment, including peer reviewers (see paras. 4.71–4.72), will be guided by its scope and should be open to people bringing fresh insights and from different cultural backgrounds. The thematic scope may require experts in different fields or disciplines or engaged in practical applications – whether in the private sector (e.g., oil and gas development, agriculture, fisheries) or government (e.g., coastal zone management, wastewater management, fisheries management). At the global level, participation by experts from the various regions is needed so that different regional conditions and concerns are fully reflected in the assessment. In all respects, balance among the experts is important (NRC 2007; Farrell and Jäger 2005). It is also important to prepare those who participate as experts so that they know what to expect and can engage constructively in a process that ensures mutual respect among all participants.

4.46 Chapter 3 indicates that experts may be nominated and/or selected through a variety of means, although governments generally nominate the experts for an intergovernmental assessment or advisory process. (The experts they nominate are not necessarily from government; they may be associated with

NGOs, research institutions or other entities). Several assessment processes specify criteria that provide the basis for expert selection. When controversial issues are at stake, selection by an international organization can strengthen both the scientific credibility and legitimacy of the process. This might be a UN body such as the Intergovernmental Oceanographic Commission (IOC) or UNEP or a respected professional organization such as the International Council for Science (ICSU) and its Scientific Committee on Oceanic Research (SCOR) (see Kimball (1996)). There are also options for international processes to obtain advice from *supplementary experts*. In some RFMOs, the Scientific Committee may, on its own decision, "seek the advice of other scientists and experts as may be required on an *ad hoc* basis" (e.g., CCAMLR); in ICES, member states decide which experts to designate as working group members, but the process is open to self-nominated participants as long as they have appropriate qualifications and are accepted by the chair of the group. The joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) also provides for self-nomination to its *pool of experts* as well as for nomination by states and a wide range of organizations. (For a description of the institutional aspects of these bodies see Annex II.)

Best Practices on the nomination and selection of experts

4.47 The Group of Experts concluded that the best practices are:

a. Establish transparent criteria and clear authority for nomination and selection of experts and document these in the assessment report;
b. Involve experts with suitable qualifications and established reputations;
c. Ensure that selection criteria and procedures are not biased for or against experts who have any particular affiliation (e.g., government, NGO, IGO, industry)
d. Specify that experts serve in their expert capacity and are free to conduct their work without inappropriate interference or influence from the government or organization for which they work, which appointed them and/or which funds their participation; any potential sources of bias or conflict of interest should be disclosed;

e. Involve an appropriate range of disciplinary expertise, including experts with traditional knowledge, as appropriate;
f. Involve experts from an appropriate range of stakeholder groups, ensuring balanced participation – for example, between industry experts and those from independent research institutions, holders of traditional knowledge and/or environmental organizations; between government experts and those from intergovernmental or non-governmental organizations;
g. Ensure geographic and gender balance;
h. Provide for limited terms of service in order to broaden participation;
i. Ensure that the *rules of engagement* are clear, so that all participants are familiar with their roles and responsibilities;
j. Provide that the expert mechanism for the assessment may seek qualified external expertise as it deems necessary;

Data and information: sourcing, quality assurance, availability and accessibility

4.48 This section considers the material available for assessments, procedures required to ensure the quality of data, information and methods used in assessments (see also the section on "peer review" below) and the availability and accessibility[16] of data and information to other researchers and the public. It refers to chemical, physical and biological data that complement each other in any assessment, as well as to social and economic data. This section also covers the need to improve interoperability of data (data exchange between data management systems) to support more integrated, ecosystem-based assessments. The need for metadata that clearly describe the data and information used in an assessment, so that they can be understood and re-used by others, is also noted.

Sourcing

4.49 It is important that assessments have recourse to all relevant information and employ established methods of analysis. Conversely, over-reliance on a few selected sources or previous assessment work undermines credibility and legitimacy. An assessment may rely heavily

16 "Availability" refers to the ability to acquire existing data, whereas "accessibility" refers to the technical ability to extract data from datasets in an intelligible form so that they can be used by others. Both terms differ from the "adequacy" of data; that is, whether or not there is sufficient information available to make an informed judgment.

on quantitative data provided by the research community and peer-reviewed reports and journals. However, where such sources are inadequate, experts familiar with the geographic area in question, unpublished datasets or documentation not published in peer-reviewed products (*grey literature*[17]) may be used, provided that the quality of this input can be assured. Historical data and information are other important sources and may help to establish earlier baselines than found in more current sources. This may come from observations by naturalists, statistical archives or as a result of historical research projects like the History of Marine Animal Populations (HMAP) of the Census of Marine Life (CoML). A number of major international research programs such as the global change research programs under the auspices of ICSU are also important sources of data and information, and traditional knowledge (TK) is important in many regions (see Box 4.3). Experts also may extrapolate from reliable findings in one region to draw inferences about conditions and trends in other regions, or at larger scales. Similarly, models that make use of data on pressures and impacts in one area can be employed to estimate the impacts of similar pressures under similar conditions in other areas. All such information sources can usefully be applied in an assessment but quality assurance procedures should always be in place to ensure reliability and, thus, scientific credibility.

Quality assurance

4.50 The assessment process itself, when conducted through expert working groups that review and challenge evidence presented, can serve as a rigorous quality assurance and peer review process. This holds for data quality, models, analyses and analytical methods, extrapolations and the use of TK or grey literature. Provided that the range of expertise and interpretative perspectives is adequate, this is the most reliable means to question assumptions and methods, expose unsubstantiated theories and analyses, supply contrary evidence and clarify analyses and conclusions. Such a process may be as or more rigorous than the standards for peer review adopted by established journals.[18]

17 This includes working papers, government reports, students' theses and technology specific information.

18 Moreover, because peer-reviewed journals look for originality, they are unlikely to publish routine assessment findings unless they contain major new findings or represent innovative approaches. This makes it impractical to require that a regular assessment rely exclusively on results published in the primary literature.

4.51 Distinct *expert group* assessment processes are a well-established means of utilizing the collective knowledge and experience of experts from different fields and backgrounds to review *quantitative* information and to supplement it with *qualitative* judgments, especially in areas where data are limited. A challenge-response format serves to ensure quality and resolve differences (Eckley 2001). This type of exercise involves workshops with broad and balanced participation among disciplines (in both natural and social sciences) and by industrial and other user groups together with environmental organizations, academic and research institutions and government scientists.[19] (For further discussion of expert group processes as a means to conduct assessments, see Annex II.)

4.52 Regarding quality assurance for TK, in one example of sectoral assessments in Canada, TK is normally evaluated in a challenge-response setting involving holders of TK and other users and experts. In most cases, consistency with scientific data sources is checked; when consistency is high, both sources play a significant role in generating assessment conclusions. When inconsistencies are found, there is an earnest effort to identify biases in the scientific data. If scientific data hold up to comparative scrutiny, they are given greater weight in the report. Any lack of consensus is explicitly noted and different perspectives and interpretations are included along with implications for management. A special issue in this context is that communities and individuals often consider TK proprietary. This has led to Canadian policies not to release such information directly, although the federal government facilitates contacts between those needing access to TK and the groups and communities holding it.

4.53 International bodies play an important role in developing standards and methods for marine environmental monitoring and assessment. These tools are often widely recognized and applied which gives confidence that, if used correctly, the data and subsequent interpretations are reliable. Examples of such organizations include International Atomic Energy Agency (IAEA), ICES (fisheries,

19 In one example, The Nature Conservancy (TNC), a leader in this type of analysis, produced a report on priorities for coastal and marine conservation in South America in collaboration with, among others, the Governments of Brazil (which led the process in Brazil with the support of TNC), Chile, Colombia, Ecuador and Peru as well as scientific institutes and/or environmental organizations in these countries and in Venezuela (Chatwin 2007).

marine pollution), World Health Organization (WHO) (methods and guidelines for pollution assessment), IOC (66 national oceanographic data centres) and UNEP. The GPA (Global Programme of Action for Protection of the Marine Environment from Land-Based Activities) clearinghouse mechanism, which is a collective effort of several UN agencies, is designed to include standards and reference methods for monitoring the effects of different categories of pollution and habitat degradation caused by land-based activities. The UN Food and Agriculture Organization (FAO) through its Coordinating Working Party on Fishery Statistics (CWP) agrees on standard concepts, definitions, classifications and methodologies for collection and collation of fishery statistics. Its partners include RFMOs and other regional fishery bodies (RFBs).[20]

4.54 Some intergovernmental processes have sought to encourage good data quality and comparability through development of manuals, training or inter-calibration exercises (e.g., HELCOM, OSPAR, Barcelona Convention (Mediterranean Sea), Regional Organization for the Protection of the Marine Environment (ROPME), IOC). FAO plays an important role in helping bring together comparable data from many regions on fishery catch and effort which can be exchanged between data management systems (interoperable data). The Red List process of the International Union for Conservation of Nature (IUCN) has developed criteria (including uniform standards), categories and methods to assess the conservation status of species as well as minimum documentation requirements to indicate when species cannot be evaluated due to insufficient information.

4.55 Accepted standards and methods for assessing issues such as water quality or fisheries (including environmental and socio-economic aspects) are essential building blocks for assessment. Not only do they give confidence that the data and analyses are reliable, they allow data on conditions and trends within each field to be synthesized and compared within and across regions (horizontal integration). Furthermore, such data can be integrated in cross-disciplinary assessments that seek to relate, for example, physical ocean properties to biological information on living

20 In another example, the IPCC prepares methodology reports or guidelines to assist countries in reporting on greenhouse gases.

resources (vertical integration). As another example of the value of accepted standards and methods, if an assessment were to cover the impacts of climate change on marine ecosystems, it could rely on the best available analysis from the IPCC without having to re-invent the climate analysis. Moreover, a common factual basis, afforded by accepted standards and methods, supports constructive dialogue among governments and others and the finding of common ground on response actions.

4.56 Apart from standards and methods, many specialist fields utilize reference levels that are derived from theory and empirical studies. For example, reference points for fisheries management are often related to the concept of maximum sustainable yield (MSY) and population dynamics theory. Harvest rates and biomass levels that are estimated to produce MSY can be considered minimum standards for management to prevent overexploitation and resource declines. That is, these reference levels should be considered as limits to exploitation, not targets for management. It is recommended that these "limit" reference points take into account other factors like stock resilience, other sources of mortality, relationships with associated or dependent species and major sources of uncertainty in guiding management strategies. From a policy perspective, reference levels enable assessment advice to be placed in context. They can quantitatively express the objectives of management as a link between science and decision making.

Availability and accessibility

4.57 Accurate records of data and analyses used in assessments are the foundation for future assessments and afford the ability to evaluate changing conditions. They are a vital aspect of an assessment's credibility, especially for scientists who wish to verify assessment findings. It is important that data preservation and access be considered at the outset of an assessment and not as an afterthought. For many developing nations there is a need to build capacity and infrastructure for data storage, management and accessibility. In addition, the public availability of assessment products and underlying data demonstrates that the process is transparent and thus helps establish its legitimacy.

4.58 The inclusion of metadata[21] in an assessment is essential for long-term preservation and stewardship of data. It facilitates data searches, the ability to extract and use data and the exchange of data between data management systems. Considering the many changes that have taken place in information and communications technologies during the past 20 years, the number of data providers is growing exponentially and centralized data infrastructures are evolving into distributed data systems. This has both positive (more data can be shared faster) and negative repercussions (concerns about quality, reliability, duplication and different versions of the data; more difficult for users to find data). There are ongoing efforts to promote metadata standards and improve data interoperability.[22]

4.59 Problems may arise between international organizations over data exchange. If the goal is to progress toward fully integrated assessments, it will be important to be able to access relevant datasets wherever they are housed and to ensure infrastructures that enable data exchange. This is an area where international organizations may need to further develop and coordinate their data policies.

4.60 FAO's Fishery Resources Monitoring System (FIRMS) aims to provide access to a wide range of high quality information on the monitoring and management of fishery resources worldwide. Through a negotiated partnership agreement with international organizations, RFMOs and other RFBs and, in the future, national scientific institutes, FIRMS represents an example of how to achieve data assimilation and accessibility by defining: (i) the rights and obligations of partners, (ii) information management policy and (iii) the conditions for the sharing of the contributed information.

21 Metadata refers to information about a dataset that describes its content, format and characteristics to ensure the data are correctly understood and interpreted. Metadata includes information such as temporal and spatial coverage of the dataset, the sampling design, ancillary data that might be included and the organization of the data in the database.

22 Four of the ICSU World Data Centres specialize in ocean data. Several organizations such as the IOC International Oceanographic Data and Information Exchange (IODE), Joint World Meteorological Organization (WMO)-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), WMO itself and the Global Earth Observation System of Systems (GEOSS) have started initiatives to organize the many data providers through interoperable, distributed data systems. IOC/IODE and JCOMM are actively promoting the adoption of a metadata standard (see http://www.oceandatastandards.org). At the regional level, a South China Sea Meta-database allowing central online access to search and collate metadata on coastal habitats and fisheries in Southeast Asia has been packaged as a template for other projects and organizations.

FIRMS also participates in the development and promotion of agreed standards for fisheries information management.

4.61 Chapter 3 notes that certain restrictions on the availability of data are relatively common. This applies in the cases of confidential commercial data from many ocean industries and data held by scientists who have not yet published their findings. Similar restrictions may apply to availability of TK, as noted above. At the same time, under the RFMOs there is general agreement that data confidentiality should not impede necessary assessments and that an appropriate set of rules defining conditions of access to data is needed. Best practice examples exist, for instance under CCAMLR,[23] where free access is usually allowed to all data submitted to the RFMO by members of the Commission (states) for purposes of analysis and preparation of RFMO documents. The rules also define what constitutes release into the public domain and specify the right of data producers and owners to be consulted on the interpretation, use and any publication based on the data. However, practices vary among the RFMOs, especially with respect to public release. In another example, HELCOM data policy provides for free access to all monitoring data submitted by contracting parties.

4.62 On the question of scientists yet to publish their findings, different processes may provide for different arrangements; the basic principle is to accommodate the scientists as long as publication follows in a timely manner. For example, data are available online for the Caribbean Coastal Marine Productivity (CARICOMP) Programme but non-CARICOMP individuals are only allowed access to data more than two years old. This allows CARICOMP researchers some time to use or publish their data before it is made available to others. Metadata access is by permission only. In another example, under the Arctic circumpolar biodiversity monitoring programme a web-based data portal will be established, with links to an array of individual web servers. In this way ownership, permissions and responsibility for the data lie with the data holder, who is usually also the data collector.

23 CCAMLR, Basic Documents, Rules for Access and Use of CCAMLR Data, December 2006.

Best Practices on data and information

4.63 The Group of Experts concluded that the best practices are to:

a. Encourage governments and international organizations to ensure that all relevant data that they hold are readily available to an assessment team; such data would include socio-economic data, information from fields other than marine science (e.g., meteorological data), historical data (e.g., of marine resources exploitation or regulation/conservation efforts) and *grey literature*;

b. Use a wide range of relevant, technically-competent information and publication sources in preparing assessments including the work of major international research programmes and promote recourse to professional information experts (librarians) for sourcing of materials, including *grey literature*;

c. Develop the necessary standards for data collection, including quality assurance;

d. Develop a policy on the availability of data and information and any conditions for its use in scientific publications;

e. Provide for website availability of all assessment reports and findings, including access to underlying scientific reports and non-proprietary data;

f. Ensure that well-defined standards are used in recording metadata;

g. Ensure that a well-defined data plan is prepared and implemented for each assessment that describes all elements and processes regarding data management, storage, preservation and exchange so as to ensure availability of metadata and long-term access to all data collected;

h. Develop a data assembly and management plan that identifies sufficient resources for the assembly of data to undertake an assessment, to maintain it for future use and to support future iterations of the assessment;

i. Develop guidance (e.g., manuals) and training programmes, with financial support where necessary, to assist governments to improve the quality and comparability of data produced and to strengthen interoperability with international data networks and systems;

j. That the assessment should examine how representative the information is for the whole of the area and time period to which the assessment pertains;

k. Use maps and graphs where possible in preparing an assessment as an aid in identifying data gaps, interpreting and analyzing data and finding links between datasets;
l. Provide for a review and challenge process among experts[24] to evaluate the data, information and methods used in an assessment; ensure balanced participation among disciplines and among relevant stakeholders from industry and conservation organizations, government, traditional communities and scientific institutes;
m. When TK is to be used in an assessment, ensure that there are clear *rules of engagement* so that all participants understand how discrepancies between data and information from TK sources and from scientific sources will be handled. Also ensure that there is a clear understanding among all parties about proprietary rights to TK remaining with the providers;
n. When *grey literature* is to be used in an assessment, specify how it is to be vetted (e.g., that it must be accepted by lead authors and available to peer reviewers as in the IPCC (NRC 2007));
o. Document quality assurance procedures for data and information in the assessment report;
p. In the assessment report, provide a clear description of the data and its limitations; explain fully:
    (i) to which parts of an assessment area the data apply, if available data and information are not representative of the whole of the area;
    (ii) any significant gaps in the data and their implications for assessment findings and for future monitoring activities;
    (iii) the period during which data used in the assessment were collected, and whether the assessment contains new data or re-uses data from earlier assessments;
    (iv) the standards and processes used in the assessment to scale information upward and downward from the scale at which it was collected, and for drawing inferences from the available information to reach general conclusions;
    (v) to which parts of the assessment area the conclusions apply, if they do not apply to the whole area.

24 This should include experts in TK as appropriate.

Treatment of lack of consensus among experts

4.64 When experts are seen to disagree, the credibility of an assessment may be diminished. Disagreement may arise due to contradictory information, differences over its interpretation or the weight particular information should be assigned. Experts may also differ over the use of a particular technique, or the assumptions underlying a particular model. It is normal practice that differing views be reported to decision-making authorities so that they are fully informed of the differences and the underlying evidence. Chapter 3 cites several examples of procedures used to deal with lack of consensus. In one example, the science advisory process for fisheries assessments in Canada, when experts cannot reach consensus they are asked to develop an agreed statement on the nature of the evidence supporting and conflicting with alternative conclusions. They are also asked to state the relative risks of each proposed option should the evidence prove to be either correct or incorrect. In this way, the advisory process produces consensus advice and fully informs decision-makers about the state of knowledge and risks. Examples of *ad hoc* scientific and technical advisory bodies that deal with controversial issues are given in Annex II.

Best Practices on treatment of lack of consensus among experts

4.65 The Group of Experts concluded that the best practices are:

a. Report all views that cannot be refuted with sound evidence together with associated assumptions and uncertainties;
b. Develop a clearly defined procedure for presenting an agreed statement of the evidence supporting contradictory data, analyses or interpretations and the associated risks;
c. Document in the assessment report the procedures used to treat lack of consensus among experts.

Treatment of uncertainty

4.66 Assessments must often deal with different types of uncertainty at different steps in the process. Proper treatment of uncertainty in the various analytical steps of an assessment is essential for its credibility. Ensuring that decision-makers fully understand uncertainties and risks through careful presentation of assessment results is vital for reaching informed decisions.

4.67 Central to the conduct of assessments is uncertainty in the data, analytical models or understanding of linkages in the system being assessed. This may be of particular concern in regions where data are severely deficient or because there are contradictory data. Scientists often seek to provide advice not only through the basic results of an assessment but also to give guidance on *model uncertainty* (uncertainty about what equation(s) to use to represent a relationship) and *parameter uncertainty* (data that have a lot of *noise* around the actual signal, trend or relationship of interest). In this way policy-makers can consider the relative risks of various decisions, given what is known about the environment. In many analytical assessments, the traditional use of statistical confidence intervals is being displaced by risk and likelihood estimates, Bayesian analyses and other methods that estimate the full probability distribution of a possible outcome or trend, rather than focusing solely on a single *most probable* value. Such methods more fully separate those conducting the assessment, whose role is to describe and estimate the risks, from those in decision-making capacities who manage the risks.

4.68 In data poor situations (regions or topics where extensive data are not available), it may not be possible to utilize the types of statistical approaches referred to above. Then, more qualitative information on both the state of the environment and the risk of management strategies may be appropriate, using a combination of the available statistical information and expert opinion. For example, methodology for evaluating relative risk qualitatively for different types of environmental factors has been developed in Australia by Hobday and others (2007). This can be broadly applied using expert opinion and a wide range of data sources.

4.69 Uncertainties may also arise over the future state of environmental or socio-economic conditions that could influence the success of response measures, or over how proposed policy options may be implemented and/or enforced. Assessments have only recently begun to deal formally with such issues. For example, the Management Strategy Evaluation (MSE) used in some fisheries assessments projects the consequences of different levels of compliance with the proposed policies and management options (see para. 4.26). The objective is to include information on which option would be more robust in the face of poor compliance and which would be effective only if compliance

were very high. Such information can be important to policy-makers both in choosing among options and in providing resources for implementation and enforcement of the chosen measures.

Best Practices on treatment of uncertainty

4.70 The Group of Experts concluded that the best practices are:

a. Report the uncertainty in analyses, not just point estimates using confidence intervals, risk analyses or qualitative assessments of uncertainty; include uncertainty about the impacts of human activities on ecosystem status and vice versa;[25]
b. Explain fully all assumptions in analyses and models;
c. Educate policy-makers and stakeholders on how to interpret the uncertainty in an assessment;
d. Given that knowledge is incomplete or inconclusive, undertake comparative assessments of the likely outcomes of each policy option under a range of alternative assumptions (consistent with available information and expert knowledge), rather than picking a single *most likely assumption* and ignoring other possibilities;
e. Assess how effective each policy option would be with different levels of compliance;
f. Document procedures used to treat uncertainty in the assessment report.

Peer review

4.71 Peer review is widely regarded as the best means for establishing the scientific credibility of an assessment. It involves review by experts in relevant fields acting in their independent capacity, although the experts may come from a variety of organizational backgrounds (e.g., scientific institutes, government agencies, NGOs, IGOs, private industry, holders of TK).[26] A diverse peer review group enables the involvement of specialists in basic research, practical management applications or users of marine resources. It broadens ownership in assessment results and enhances perceptions of legitimacy. Transparency of the peer review process

25 See for example the guidelines for reporting uncertainty in the IPCC at http://www.ipcc.ch/pdf/supporting-material/guidance-papers-3rd-assessment.pdf.

26 It should be noted that in the Principles governing the work of the IPCC (an intergovernmental body) peer review by experts is distinguished from review by governments but it is recognized that both are required. See http://www.ipcc.ch/pdf/ipcc-principles/ipcc-principles-appendix-a.pdf.

enhances both credibility and legitimacy. In Chapter 3 the Group of Experts identifies a range of modalities for peer review.

Best Practices on peer review

4.72 The Group of Experts concluded that the best practices, in addition to those dealing with nomination and selection of experts (para 4.47), are:

a. Transparency of the peer review process and the selection of reviewers;
b. Select reviewers based on clear criteria and from a broad range of backgrounds with opportunities for all stakeholders to nominate peer reviewers;
c. Use reviewers not involved in the assessment ("external");
d. Diligence in ensuring that reviewers are drawn from a broad range of disciplinary and interpretational perspectives with expertise and knowledge to take part in the review;
e. Clear schedule and deadlines for submission of comments and completion of the review process;
f. Well-defined responsibilities for authors receiving reviewer comments;
g. For complex or controversial assessments, nominate independent peer review editors to oversee and verify adherence by authors to agreed peer review procedures;
h. With their permission, identify reviewers in the report and make available publicly their comments and responses to them, especially in the case of controversial issues or findings that involve significant levels of uncertainty;[27]
i. Document peer review procedures in the assessment report.

Effective communication

4.73 Effective communication is essential for an assessment process, from the design stage through to presentation of results (Miller and others 1997). (The previous sections on the "science/policy relationship" and "stakeholders" already cover aspects of this topic.) Depending on **what** is communicated, **to whom**, **when** and **in what way,** an

27 For example, IPCC procedures explicitly require that a full record of all reviewers' comments on draft reports be maintained and made available upon request. GESAMP procedures provide that the draft report, with a description of the working group's responses to substantive issues raised by reviewers, be submitted to the full Group of Experts for consideration and final approval. Some processes make the names of peer reviewers public but not the reviews themselves.

assessment can have varying levels of influence on decision-makers and other stakeholders involved in the issues under consideration. During the process, those requesting the assessment and relevant stakeholders should receive regular progress reports as a means to enhance dialogue and mutual understanding. A clear description of how the assessment was carried out and who was involved strengthens credibility and legitimacy. Informative products targeted to each identified audience enhance the assessment's relevance and credibility (NRC 2007).

Best Practices on communication

4.74 The Group of Experts concluded that the best practices are:

a. During the assessment, provide for regular progress reports to identified target audiences and opportunities to comment on draft documents (distinguishing peer review from broader external review);
b. In the early stages of an assessment, develop a communications strategy for disseminating results in consultation with each target audience;
c. Ensure that targeted policy-makers receive special attention in the communications strategy;
d. Differentiate outputs so that more detailed, technical material is tailored for readers from a specific sector, such as fisheries managers and the fishing industry or other sectors, with a precise summary for high-level officials;
e. Use charts, graphics and indicators judiciously for different audiences to capture the attention of important but less specialized constituencies while avoiding over-simplification for knowledgeable policy-makers, managers and users;
f. Use maps and spatial data to present information visually, both for the public and specialized audiences;
g. Where necessary make a special effort to reach target audiences, for example the travelling presentations taken to Arctic aboriginal communities of Canada (see Box 4.3);
h. Use a talented science writer to produce accurate but non-technical products for a wider public audience and/or high-level officials;
i. Provide for website availability of all assessment reports and findings, including access to underlying scientific reports and non-proprietary data.

Capacity building and networking

4.75 "Investments in capacity building can have payoffs in multiple areas, including (1) expanding the informed audience for assessments, (2) contributing to future assessment effectiveness, (3) expanding the ability of decision-makers to act on scientific information, (4) equipping participants with new knowledge on assessment methodology and tools, and (5) building a scientific community that is more sensitive to the needs and concerns of the broader society" (NRC 2007, pp. 9–10). Such investments enhance the scientific credibility, legitimacy and relevance of an assessment (Farrell and others 2001). It is important to bear in mind, however, that different approaches have been successful in different settings; there is no single solution.

4.76 Chapter 3 notes the variety of capacity-building initiatives but it stresses the importance of the development of specialist networks and interactions between them. Box 4.4 describes the utility of networks, drawn from an analysis of a GEF International Waters project in East Asia. They extend contacts and information exchange among experts involved in assessment and related research, bringing new knowledge and perspectives to an assessment process, while participation in the process strengthens individual capacities and thus the process itself.

Box 4.4: **Networks in the South China Sea and Gulf of Thailand GEF project on degradation of coastal habitat (2002–2007)**

Creating regional working groups on specific topics like mangroves or fisheries allows the consolidation of highly specialized knowledge and experience in each field. This can be a useful precursor to a more comprehensive assessment programme involving a broader range of experts with different interests and concerns. Once the different specialized technical networks are brought together, not only are the mangrove scientists networked, they are also linked, nationally and regionally, with specialists in other habitats, pollution and fisheries as well as lawyers and economists. The opportunities for learning are expanded when, for example, the economists provide advice to the biologists on economic evaluation of species or habitat, and the legal specialists provide advice to national committees regarding how to strengthen the national legal regime.

These developments contribute to deeper understanding of marine environmental concerns and priorities and to achieving consensus on problems and appropriate responses (VanDeveer 2005). This occurs at all levels. In relation to assessment activities, NGOs like Conservation International have pioneered rapid marine assessment techniques which can be especially useful in data sparse environments. Moreover, collaboration and data exchange through major international research programmes that involve scientists from around the world contribute not only to global knowledge but also to regional and national knowledge, thus assessment capacity.

4.77 Large-scale and more comprehensive assessments, notably in the GEF International Waters LME initiatives, can be particularly effective at identifying and concentrating on capacity-building *priorities*, which helps direct resources more efficiently (see Box 4.1).

Best Practices on capacity building and networking

4.78 The Group of Experts concluded that the best practices are:

a. For governments and regional bodies to identify technical skills and infrastructure needed to strengthen capacity in marine monitoring and assessment and determine priorities;
b. For governments and regional bodies to collaborate with other international bodies to identify gaps and shared priorities as a basis for developing a coherent program to support capacity building in marine monitoring and assessment;
c. To develop a data collection and management strategy that sets out clearly basic data requirements for an assessment and sufficient resources to meet these needs; to maintain data and information for future use; and project specific data and resource requirements to improve data collection and management in support of future iterations;
d. To develop quality assurance procedures and guidance (e.g., a manual) to assist governments and international bodies to improve the quality and comparability of data produced;
e. To provide training materials and training venues for marine monitoring and assessment;
f. To establish fellowship programmes to develop marine science and assessment skills.

Post-assessment evaluation

4.79 The Group of Experts considers *iteration* (a continuous cycle of evaluation, updating and improvement) a key to influential assessments. In this way the process can keep up with scientific developments, both knowledge and methods, and provide timely guidance to decision-makers enabling them to update policy measures in light of new evidence. *Iteration* applies also to the process itself. The process must be able to respond flexibly to periodic critical evaluations, new insights and recommendations for improvement.

4.80 It is essential that any regular assessment provide explicitly for a stage of learning and evaluation (e.g., Farrell and Jäger (2005) and Tuinstra and others (2008)). This post-assessment evaluation must consider: (1) whether or not the subsequent assessment should be modified (objectives or scope, for instance) or include new participants due to new scientific knowledge that could change earlier findings and recommendations; (2) new developments in analytical tools and methods that would improve the assessment; and (3) the state of implementation of response measures and any failures or impediments to implementation. It must also review the usefulness and timeliness of previous assessment products and how they were used by decision-makers. In this way, expert assessors can be made aware of their influence and any improvements that could be made. A transparent evaluation and subsequent improvements strengthen the relevance and credibility of assessment products and make the process more accountable, enhancing legitimacy.

4.81 Chapter 3 and paras. 4.24–4.26 note that there has been some progress towards more regular, timely and iterative marine assessments that support adaptive management, but such assessments remain the exception. Chapter 3 also notes some progress in the conduct of *process* evaluations.

Best Practices on post-assessment evaluation

4.82 The Group of Experts concludes that the best practices are:

a. For an individual assessment, provide explicitly that the post-assessment evaluation considers advances in scientific[28]

28 The time period for review of scientific knowledge will vary depending on the state of the science; for example, the level of uncertainty or the rate of acquisition of new knowledge. One means to encourage post-assessment evaluation is for the experts to state their views on the changing state of knowledge and how this may impact their findings; for example, that findings are likely to be overtaken by scientific developments after a stated period of time.

knowledge and techniques, the effectiveness of response measures and how the assessment influenced policy-makers;

b. For the assessment process, provide explicitly for an evaluation to determine how both products and the process itself could be improved;

c. Both for individual assessment products and the process itself, provide for evaluations to gain both *insider* and *outsider* perspectives on their strengths and weaknesses; include both assessment participants and users in the evaluation to ensure that the next iteration responds to changing needs.

INSTITUTIONAL ARRANGEMENTS FOR ORGANIZING AN ASSESSMENT

4.83 Chapter 3 identifies a range of institutions that currently carry out marine assessments. This section highlights three issues of particular significance for the institutional arrangements of a Regular Process: establishing an appropriate boundary between science and policy, providing for stakeholder involvement and the importance of building a coherent system of assessments for the marine environment so that the whole is greater than the sum of the parts. The Group of Experts attaches particular importance to these issues based on the findings of Chapter 3, the forgoing analysis of best practices and a further examination of institutional arrangements employed by existing assessment processes. The purpose of this section is to draw attention to institutional options that could be adapted for the Regular Process so that both process and products are perceived as relevant, legitimate and credible. (Annex II contains a summary of the institutional arrangements for a number of established marine assessment processes and a few others from which this analysis is drawn.[29])

29 Annex II covers (1) formal arrangements at regional and global levels for marine assessment (ICES, PICES (Pacific ICES), RFMOs, OSPAR, LME Commissions, a coordinating mechanism for institutions involved in assessment in the South Pacific Council of Regional Organizations (CROP), GESAMP, London Convention, AoA); (2) networks and expert group processes for marine assessment (Mediterranean and Wider Caribbean Regional Seas programmes, TDA/SAP processes, FAO working groups and the IUCN Red List assessments); (3) the Marine Stewardship Council (MSC), a specialized, independent process; (4) special mechanisms established to deal with scientific uncertainty or controversy under the IWC, London Convention, Convention for the Conservation of Southern Bluefin Tuna (CCSBT), Barcelona Convention and at the national level; and (5) a few assessments outside the marine realm. From the climate domain, Annex II covers the IPCC and ACIA. It notes also the Millennium Ecosystem Assessment (MA) and current discussions regarding an Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) to follow up the MA and the International Mechanism of Scientific Expertise on Biodiversity (IMoSEB) processes.

4.84 Normally, the instrument establishing an assessment process identifies and/or establishes mechanism(s) to govern and guide the process (*management* mechanism) and to undertake expert assessments (*expert* mechanism), and it specifies their composition and responsibilities. It also makes provision for a secretariat. This instrument establishes the overall principles and objectives for the process; it specifies to whom the mechanisms are accountable and where responsibility lies for agreeing on the Terms of Reference for individual assessments. It may provide that the process be hosted by one or more existing institution(s), such as an intergovernmental organization or a respected professional scientific organization that can convey credibility and legitimacy (Farrell and Jäger 2005).

4.85 As for management mechanisms, the Group of Experts found that there are basically four types, described in more detail in Annex II: formal bodies with a defined intergovernmental component to oversee the process (e.g., RFMOs, ICES, IPCC); a well-established process overseen by a group of UN agencies, notably GESAMP; a *mixed* mechanism (comprised of members from governments, IGOs and other international organizations), such as the Ad Hoc Steering Group of the Assessment of Assessments (AoA) and the Steering Committee of the ACIA; and expert networks with inherently flexible structures and recourse to a wide range of expertise (e.g., GOODS, MA, IUCN Red List process) which may or may not be directly linked to intergovernmental decision making and/or an established institution. Other variants include the TDA/SAP process utilized in the GEF International Waters projects and the independent Marine Stewardship Council (MSC) and similar bodies.

Boundary between science and policy: the role of governments (and other stakeholders) vis-à-vis experts

4.86 Assessment processes generally maintain a clear distinction between the management mechanism that oversees the process as a whole and a technical steering committee that provides leadership and supervision for the experts carrying out the assessment. This helps establish an appropriate boundary between the experts – who should be insulated from inappropriate influence – and the members of the management mechanism. This distinction is clear in treaty-based assessment processes like RFMOs and ICES but is found

equally in the ACIA and GESAMP. The Group of Experts found it essential that the roles and functions of both bodies be clearly articulated to avoid misunderstanding and ensure the integrity of the process (see paras 4.36–4.41). Agreed procedures for nomination and selection of experts that avoid bias and ensure that experts serve in an expert capacity are also essential.

4.87 When it comes to the role of governments and other stakeholders in the review and acceptance of assessment products, there are different models. While governments predominate in most cases, their involvement varies from a relatively *heavy* role in the IPCC in reviewing draft and final products, to a *lighter* role for government review alongside expert peer review as in the AoA process, which leaves it to the experts to take into account reviewer comments and finalize assessment products. The more usual approach is to separate the expert body responsible for finalizing scientific evaluations (including analyses of response options if so requested) from the intergovernmental body or bodies that receive the final products, consider their implications for management and policy and decide on an appropriate course of action.

4.88 Whichever model is applied, the Group of Experts found that while a strong link between the assessment and relevant decision-making processes is vital, and should promote dialogue between them, there should be a clear understanding from the outset that the experts have the final word with respect to the accuracy and completeness of the factual analyses and their interpretation. Conversely, the experts may contribute to and review policy recommendations developed by governments and other stakeholders on the basis of the expert analyses – to ensure scientific and technical accuracy – but they do not have the final say over these recommendations.

Stakeholder involvement

4.89 Recent analyses of assessment processes have stressed the importance of involving not only governments but other stakeholders in the assessment process, in order to incorporate their knowledge and as a means to strengthen their support for follow-up actions. It is the institutional arrangements of the assessment process that provide for stakeholder participation, both through the instrument establishing the process and through the

policies and procedures adopted by the management mechanism. Further provisions for stakeholder participation would be agreed in the pre-assessment stage, taking into account the scope of the assessment and its implementation plan. It is important to underscore that there are a number of ways to accomplish this, only one of which is involvement as experts, as set out in paras. 4.43–4.47. Moreover, participation by other stakeholders does not undermine in any way the role of governments. Stakeholders may put forward their group's interests at various stages. On the other hand, if they take part in an assessment as experts, they should serve in an individual expert capacity and not represent any interests in a partisan or advocacy manner.

Linking existing assessment processes

4.90 Existing assessment processes and marine specialist networks present both opportunities and challenges for the Regular Process. They are a proven vehicle for strengthening communications and information exchange, both at the technical level and between experts and policy-makers:

a. within a given specialization, between those engaged in marine research and assessment across regions;
b. between different specializations, both within and across regions; and
c. among assessment professionals in different disciplines, environmental, social and economic, including policy and law.

Nevertheless, greater efforts will be needed to establish and enhance these connections.

4.91 An equally important consideration is how to promote greater collaboration between assessment processes: (1) to achieve *horizontal* integration across regions with respect to specialized data collection and assessment in fields such as fisheries, habitats or water quality, including information on socio-economic aspects; and (2) to advance *vertical* integration at regional, sub-regional and supra-regional scales so as to reflect relationships among ecosystem components and between ecosystems, including nesting small-scale assessments within larger processes thus providing a more coherent picture of the state of the marine environment. Of special note on both counts, the GEF International Waters assessments in LMEs, by promoting ecosystem approaches and a common modular

framework of indicators for the different projects (see Box 4.1), appear to be making progress, but further evaluation will be needed as these projects evolve. The 2004 North Pacific Ecosystem Status Report produced by PICES (See Annex II) is a useful example of *vertical* integration. With regard to *horizontal* integration, global bodies have an important role in promoting common standards and approaches across regions, as noted above. There are also examples of linking marine assessment processes with air pollution assessments (see note 3) and freshwater inputs (TDAs, Global International Waters Assessment (GIWA)), while regional and global climate assessments increasingly cover interactions with the marine environment (ACIA, IPCC). Another issue is the need to take into account in planning assessments the different time frames over which a number of marine environmental processes and impacts occur.

4.92 A further challenge is the specialized focus of certain bodies requesting or undertaking an assessment. Some concentrate on a particular industry/sector (e.g., fisheries, shipping) and may take an integrated approach to that sector by looking at socio-economic aspects as well as ecosystem uses and impacts. Others may focus on an ecosystem component (e.g., coral reefs, seabirds), considering both socio-economic aspects and a range of natural and anthropogenic pressures. This may result in a degree of overlap or redundancy but, more significantly, the different processes may not utilize the same data and methods and may not come to the same conclusions. This not only raises questions about which is the more authoritative assessment, it can also fail to produce a complete picture of the state of the marine environment across sectors and ecosystem components. To overcome the latter, it is especially important to better link the international communities of experts providing sectoral assessments (e.g, fisheries assessments for RFMOs) and those conducting thematic conservation assessments (species and habitats) both at national and international levels (e.g, through IUCN, UNEP/World Conservation Monitoring Centre (WCMC) and other national and international conservation organizations). These linkages can lead to collaboration and the development of a common approach that serves both communities and their clients.

4.93 Additional steps will be needed to achieve *fully integrated* marine assessments, including socio-economic aspects, on an ecosystems

basis. Such an approach will provide the knowledge necessary for more integrated management of human activities. There are a few examples of institutional processes that are evolving toward better integration and that hold some promise for other regions. These include the GEF International Waters TDAs, the increasingly comprehensive OSPAR QSRs and the HELCOM assessments. The TDAs incorporate a substantial amount of socio-economic analysis and the *process* is especially conducive to interdisciplinary interaction at national and regional levels. The recent integration of the three ICES advisory committees into a single body helps ensure that advice on fisheries management, the marine environment (pollution) and ecosystems is better integrated.

4.94 The Group of Experts believes it is especially important to devise mechanisms to promote *integrated ecosystem* assessments that would enable decision-makers to set priorities across sectors and ecosystem components, thereby facilitating long-term conservation and sustainable use of marine ecosystems. *Fully integrated* assessments that incorporate social and economic aspects provide a more substantial basis for evaluating trade-offs and setting priorities.

4.95 More integrated assessments at the regional level are especially appropriate in view of the scale of many ocean problems. They will provide a more coherent basis for decision-makers to manage the full range of human activities impacting the marine environment. They will require greater cooperation and collaboration not only among states but also among the numerous regional and global organizations, both governmental and non-governmental, that currently undertake relevant data collection and assessment initiatives. It is important that LME TDA assessments and the regional data collection programmes of global bodies like IOC and FAO be linked with the relevant regional seas programmes. The same is true for species and habitat assessments carried out by other organizations, especially as they adopt a more regional (as opposed to global) focus. The regional seas bodies can serve as a useful nucleus in some regions but need to build partnerships with other observation and data collection programmes and with other regional management systems (e.g., RFMOs).[30]

30 For example, the MoU signed by both the NEAFC and OSPAR Commissions in September 2008.

4.96 For open ocean and deep-sea areas, there are fewer research, data collection and assessment initiatives, but collaboration and data exchange among them is especially important in view of limited knowledge of these environments. So, too, are linkages with large-scale global change research programmes. Because there are fewer institutions engaged in this area it may be easier to forge collaborative partnerships.

4.97 Thematic and specialized assessments, sectoral assessments, more integrated ecosystem-based assessments, regional and global assessments are all building blocks for a regular global marine assessment process that embraces environmental, social and economic aspects. Assessments designed to advise existing decision-making processes remain a necessary component of those processes, although progress toward ecosystem-based approaches is also important. Where different sectors impact marine ecosystems, it is essential to design assessments that take all these sectors into account. In every case, the engagement of an existing assessment process in a new partnership requires trust in order to agree objectives that are mutually beneficial. This can take some time.

4.98 A regular global marine assessment, through larger-scale analyses, could provide an overview of linkages (and gaps) between regional assessments and also cover open ocean and deep-sea areas. By conceptualizing the problems of the marine environment in new ways, such as how to enhance food security or alleviate poverty while reducing pressure on marine ecosystems, it would inevitably encourage experts from all backgrounds to adapt and apply knowledge in a more integrated and effective manner – at both regional and global levels.

4.99 The greatest challenge for a Regular Process will be to harness the skills and opportunities of different existing assessment processes toward these goals and create a "system" or "network" to serve the many regional and global ocean governance bodies.

4.99a A final consideration is the relationship between the Regular Process and the follow-up to the Millennium Ecosystem Assessment, including the possible establishment of an Intergovernmental Platform on Biodiversity and Ecosystem Services

(IPBES – See Annex II). In the view of the Group of Experts, the Regular Process as described here is the appropriate mechanism for generating in-depth analyses and guidance for decision-makers, in particular at regional and global levels of ocean governance. It will concentrate on the special characteristics of marine ecosystems, including linkages with terrestrial/freshwater and atmospheric systems in collaboration with other assessment processes. If the *process* is considered credible, legitimate and policy relevant, its *products* will be seen as authoritative and influential. This would ensure a respected analytical basis for a report covering marine biodiversity and ecosystem services and avoid duplication of effort. The Regular Process would also be in a position to deliver products tailored for the many specialized regional and global ocean governance arrangements.

CONCLUSION

4.99b In Chapter 4, the Group of Experts has derived several principles and a number of best practices as guidance for the establishment and operation of a Regular Process. Issues of particular significance for the institutional arrangements of the Regular Process, which emerge from the analysis of best practices, are highlighted; that is, the boundary between science and policy, stakeholder involvement and the importance of building a coherent system of assessments for the marine environment. Another important consideration in developing institutional arrangements is the body, or bodies, to whom the Regular Process will be accountable. The *positioning* of the Regular Process is equally vital; that is, how on the one hand it builds upon existing assessment processes at all levels to improve support for decision-makers, and on the other hand how it relates to the many intergovernmental processes on oceans with decision-making responsibilities. Chapter 5 presents a framework and options for a Regular Process for global reporting and assessment of the state of the marine environment, including socio-economic aspects, under the United Nations.

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