



The CLME Information Management System (IMS) and Regional Environmental Monitoring Programme (REMP)

Final report on IMS/REMP development and implementation

Deliverables D.2.1, D.2.3, D.2.4 and D.3.7

The “Sustainable Management of the Shared Living Marine Resources of the Caribbean Large Marine Ecosystem (CLME) and Adjacent Regions” is a GEF funded Project. Its main objective is the Sustainable management of the shared Living Marine Resources of the Caribbean LME and adjacent areas through an integrated management approach that will meet the WSSD target for sustainable fisheries.

This report describes the activities deployed in the context of the IMS/REMP component of the CLME project, in the period between 12 December 2011 and 30 June 2013, and the results achieved. The report also provides a roadmap for IMS/REMP and activities to be included in the next phase of the CLME project.

This deliverable D.3.7. includes the following deliverables: D.2.1. (Chapters 2, 3, 4 and 5), D.2.3 (chapters 7 and 13), D.2.4. (Chapter 7, 8, 19) and D.3.1. (Chapters 2, 3, 4 and 5).

Documents related to the activities in the context of IMS/REMP are available from the IOCARIBE website <http://iocaribe.ioc-unesco.org>

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0. EXECUTIVE SUMMARY

This report describes the activities deployed in the context of the IMS/REMP component of the CLME project, in the period between 12 December 2011 and 30 June 2013, and the results achieved. Moreover, the report proposes a roadmap for activities related to IMS/REMP to be included in the next phase of the CLME project.

Under the leadership of the IOCARIBE office of UNESCO-IOC, more than 75 experts from about 50 institutions and organisations provided valuable contributions to the IMS/REMP activities. These included (in alphabetical order):

- Authority of Aquatic Resources of Panama, ARAP
- Barbados Coastal Zone Management Unit, BCZMU
- Biomunicipios, Colombia
- Black Holes, The Netherlands
- Caribbean Regional Fisheries Mechanism, CRFM
- Central America Fisheries and Aquaculture Organisation, OSPESCA
- Centre for Resource Management and Environmental Studies, CERMES (University of the West Indies), Jamaica
- Colombian Ocean Commission, CCO
- Coopesolidar, Costa Rica
- Department of Fisheries, Saint Lucia
- Department of Marine Resources, Bahamas
- Fisheries Division Antigua and Barbuda
- Fisheries Division, Dominica
- Fisheries Division, Trinidad and Tobago
- Fisheries Division, St. Vincent & The Grenadines
- Food and Agriculture Organisation, FAO
- Gulf and Caribbean Fisheries Institute, GCFI, USA
- Institute for Fisheries Promotion, IFOP, Chile
- Institute for Marine Research, INVEMAR, Colombia
- Intergovernmental Oceanographic Commission, IOC (including IODE, ODINCARSA, GOOS)
- International Council for the Exploration of the Seas, ICES, Denmark
- Marine Institute of Peru, IMARPE
- Meteorological Department, Curacao
- Ministry of Agriculture, Grenada
- Ministry of Agriculture, Animal Husbandry and Fisheries, Surinam
- Ministry of Environment, Haiti
- Ministry of Environment and Energy, Costa Rica
- Ministry of Environment and Natural Resources, Dominican Republic
- Ministry of Environment and Natural Resources, Guatemala
- Ministry of Environment and Sustainable Development, Colombia
- Ministry of Fisheries and Aquaculture, Brazil
- Ministry of Natural Resources and Environment, Honduras
- Ministry of the People's Power for the Environment, Venezuela
- Ministry of Public Education, SEP, Mexico
- National Commission on Knowledge and Use of Biodiversity, CONABIO, Mexico
- National Environment and Planning Agency, NEPA, Jamaica
- National Oceanographic Data Centre, Mexico
- National University of Mexico, UNAM (Institute for Marine Sciences and Limnology)
- Quinta Verde, Mexico
- Sabana-Camaguey project (UNDP, GEF), Cuba
- SOD-Next, The Netherlands
- Texas A&M University, USA
- The Nature Conservancy, TNC, Florida
- UNEP-Caribbean Environment Programme, CEP, Jamaica
- University of Panama
- University of South Florida, USF
- Western Central Atlantic Fishery Commission, WECAFC
- World Meteorological Organisation, WMO, Switzerland

The initial integrated implementation plan for IMS/REMP, developed at the IMS/REMP Inception Meeting of December 2011, was based upon the recognition by the Caribbean countries that the living marine resource management can only be effectively addressed through the adoption of an Ecosystem Based Management (EBM) approach, and application of the Ecosystem Approach to Fisheries (EAF) that is found in the FAO Code of Conduct for Responsible Fisheries. This approach requires a thorough baseline assessment of the system components and a careful monitoring of the changes they are undergoing. The CLME project has achieved this aim by following the standard LME modular assessment approach and the development of an agreed

decision and planning framework by applying the GEF TDA/SAP process. This approach includes an important data and information component: IMS/REMP.

At the start of the IMS/REMP activities, sources of data and information on ecosystems, environment and related subjects in the region were difficult to identify and to access. Moreover, in the light of the needs of CLME and of regional decision-making on shared marine living resources, the data and information often was incomplete, not updated and lacked common standards.

IMS/REMP therefore has dedicated its efforts to the following three main issues:

- Facilitating the location of data and information sources
- Improving the accessibility of data and information
- Promoting the good management of data and information, including the harmonization of methods for monitoring of ecosystems and environment

The activities of IMS/REMP included three key elements:

- Direct contacts with stakeholders and other relevant experts
- Workshops on relevant issues
- Work by contracted experts

The main tangible result of the IMS/REMP activities is the successful development and implementation of a prototype (beta version) of the Information Management System (IMS), an online "regional meta-database supporting an ecosystem approach to fisheries (EAF/ EBM) in the Wider Caribbean Region (e.g. fisheries, environmental, biological, pollution and socio-economic data and information)". The IMS acts as a regional metadata directory referring to sources of data and information relevant in the context of the CLME project, and to this end it contains metadata information on a wide range of themes. As such the IMS serves to support the proposed SAP Strategies, Interventions and Actions, and it allows monitoring the progress of their implementation, as well as of their impacts and results.

As another important step forward, the CLME community has become aware of the importance of data and information as an essential basis for decision-making in the region. This is expected to lead to the establishment of a network of "national data and information coordination committees". These Committees should be composed of representatives of all relevant Ministries as well as of other stakeholders or they could be one of the responsibilities of the National Intersectoral Committees (NICs) and probably also include the national contacts established at the IMS/REMP Promotion and Awareness workshop.

Main issues related to IMS/REMP to deal with in the next phase of CLME include: i) establishment of a regional baseline of harmonized data and information on ecosystems and environment, ii) regional harmonized monitoring of ecosystems and environment, and iii) regional agreement on a data policy facilitating the sharing of data and information. This will strengthen the capabilities of IMS/REMP to respond to specific policy questions.

1. BACKGROUND

The background for the IMS/REMP development and implementation is formed by the Caribbean Large Marine Ecosystems project, CLME. In order to understand this background, a brief sketch is provided on the CLME project.

The specific objectives of the CLME project can be summarized as follows:

- to identify analyze and agree upon major issues, root causes and actions required to achieve sustainable management of the shared LMR's (Living Marine Resources) in the Caribbean Sea LME in a manner that is consistent with relevant international agreements, e.g. the Law of the Sea, the UN Fish Stocks Agreement;
- to improve the shared knowledge base for sustainable use and management of the transboundary LMR's by compiling and sharing existing information, filling critical data gaps and improving databases for assessments, planning and policy formulation;
- to implement legal, policy and institutional reforms to achieve sustainable transboundary LMR management; and,
- to develop an institutional and procedural approach to LME level monitoring, evaluation and reporting.

The CLME project elements are:

- characterise and analyse the root and underlying causes of transboundary issues relating to the management of marine resources in the CLME through the mechanism of a Transboundary Diagnostic Analysis (TDA) and develop and agree on a Strategic Action Programme (SAP) to address those causes;
- compile and share existing sources of information required for good governance of marine resources, and identification and filling of knowledge gaps through appropriate technical programmes;
- establish a culture of networking and cooperation among the countries for management of marine resources, focusing on strengthening existing institutions and structures;
- establish a monitoring and evaluation framework for the ecosystem status of the CLME in line with the ecosystem management approach and SAP implementation;
- create successes that serve as examples of how countries can collaborate to manage transboundary marine resources through 'Strengthening by Doing'.

The initial integrated implementation plan for IMS/REMP, developed at the IMS/REMP Inception Meeting of December 2011, was based upon the recognition by the Caribbean countries that living marine resource management can only be effectively addressed through adoption of EBM approaches and application of the Ecosystem Approach to Fisheries (EAF) that is found in the FAO Code of Conduct for Responsible Fisheries. The CLME project has achieved this aim by following the standard LME modular assessment approach and the development of an agreed decision and planning framework by applying the GEF TDA/SAP process. This approach requires a thorough baseline assessment of the ecosystem components and their environment, and of the changes they are undergoing. In order to meet this requirement the CLME project includes an important data and information component: IMS/REMP.

2. IMS/REMP GENERAL APPROACH

On the basis of the findings of the IMS/REMP Inception Meeting, and taking into account the limitations of time and funds, the design and development of the CLME Information Management System, IMS, has concentrated on the provision of references through metadata to existing data and information sources. This metadata approach was chosen in view of the current sensitivities in the region with respect to free and open access to data and information. Therefore, the IMS provides the users in the region with a dedicated directory with references (links) to the multitude of sources of data and information. In the contacts with potential users, including stakeholder organizations, the latter was emphasized as a very important and useful role for the IMS.

The identification of various monitoring programmes in the region, and the inclusion of their metadata in the IMS, allows to identify potential sources of data and information that could serve to generate Ecosystem Status Indicators (ESI) describing the status and track the trends of the CLME ecosystems and environment (status, stress reduction and process indicators) in a cost effective and technically feasible way. However, from the metadata in the IMS it can be concluded that not all monitoring programmes in the region meet the essential criteria of updatedness, continuity and regional harmonization, required for a valid contribution to the SAP process and governance in the region. Therefore, additional efforts will be needed for regional harmonization and for ensuring quality and continuity of these monitoring programmes.

Special consideration was given to also include socio-economic data and information, in order to allow an assessment through the corresponding indicators of the effect of the SAP interventions and actions on the livelihoods of the fishing communities, and on other socio-economic issues.

As was confirmed by the Inception Meeting (deliverable D.1.1.), the long-term regional role of the IMS/REMP combination is the provision of references to data and information sources serving various user communities, including governance and decision making besides academic and private industry. This role needs to be based upon a network of committed data and information gatherers and analyzers that provide the required information to the IMS/REMP portal, thus populating a metadata directory which allows the users to locate the sources of information and data they need.

The IMS/REMP mechanism consists of:

- The IMS core system that allows for complex searches and queries across a wide variety of metadata references, which can be used to locate sources of data and information on relevant themes for CLME;
- A network of national and regional institutions, expert networks and personal contacts in the CLME countries;
- A network able to provide the data and information required to generate the products and services (indicators) required by the SAP process and governance: this network includes local, national and regional organizations, and for the moment only refers to the sharing of metadata, i.e. references to data and information and not of the data/information itself, in view of the sensitivities with respect to the sharing of data and information;
- A demand-driven procedure for maintaining and engaging the network and the IMS system based upon the subsidiarity principle, and through contributions by committed agencies-providers, including: UNEP-CEP, LBS, TNC, FAO, IOC (IODE, IOCARIBE, ODINCARSA), and CERMES;

- A procedure for coordinating the preparation of agreed indicators for the IGO's: a first approach to this mechanism is available in the IMS (button: Indicators) according to the 3 x 3(4) matrix combining the identified three (four) problem areas with the relevant three fisheries sectors, and identifying sources of the data and information needed to generate the corresponding indicators;
- A procedure for delivering indicators to the IGO's and the CLME regional governance component: the IGO's and the regional governance component have free access to the metadata reference information of the IMS, so anytime they can easily identify the specific sources of data and information that support the generation of the indicators they need.

3. IMS DEVELOPMENT

The objectives of IMS were defined as: i) to facilitate monitoring and evaluation of the status of ecosystems and environment in the CLME area, and ii) to assess the status and impact of implementation of the SAP process in the various participating countries as well as regionally.

The IMS can be considered as a "management tool joining data and information into a meta-database with regional scope". As such it facilitates the search for data and information available from CLME partner organizations and other relevant sources in the various phases of the decision-making process (policy cycle). Issues such as access to and exchange of data and information will be covered elsewhere in this report.

The IMS functions as a Management Information System (MIS) for the CLME project, especially where it allows tracking the implementation and impacts of the SAP and its strategies in the countries of the region. To this end specific tables were included, as checklists with dedicated indicators. The national contacts of the CLME project in the various countries are in the best position to keep this information updated.

In addition, the IMS provides its users with integrated access to sources of environmental, biodiversity and socio-economic data and information across various disciplines. In this way, IMS supports and facilitates the ecosystem-based approach to management of fisheries ecosystems as foreseen by CLME, providing dedicated access to sources of data and information for a variety of users and applications, and through a user-friendly access interface. This access also includes locating the relevant experts and expertise associated with the resource and essential for analysis and interpretation, generating indicators, facilitating regular reporting and responding to ad hoc requests for policy advice.

4. IMS SPECIFICATIONS

In view of the requirements set by the CLME project (e.g. the ProDoc and the Inception Meeting), the Terms of Reference for the IMS development and implementation were formulated as follows:

- Provide portal facilities in the form of links to data and information on the CLME region's ecosystems and related issues; this includes the design of an attractive, systematic and user-friendly interface (in English and Spanish), and the functionality to add and organize links to relevant sources of data and information;
- Be able to handle a wide variety of sources and types of data and information; this includes inter alia: measurements and observations on ecosystems, environment and socio-economy including status and trends, fisheries efforts, reports and other

documents, meetings, who's who, ongoing and past monitoring programmes, progress of CLME, status of SAP implementation, abbreviations and acronyms, methods and technologies for monitoring, taxonomic information on relevant species, announcements of meetings etc., funding opportunities, fora and other groupings on relevant subjects for the CLME community, relevant national and regional laws, regulations and agreements (and status), and fisheries market information. Initially the focus will be on monitoring programmes relevant to the priority themes chosen. Other themes and sources will be included on the basis of user suggestions (demand-driven).

- Include a facility to search the links and their metadata descriptions as included in the IMS, with specific queries using a built-in thesaurus of search keywords; the user will be able to specify a number or logical combination of search keywords, possibly along with a specification of time/date/period and geographic boundaries; the system will provide on-line real-time assistance on allowed keywords and on the required formats for temporal and spatial boundaries (look up lists); search results are standard displayed as a list;
- Include a facility to display information in the form of maps or images; this relates to the possibility to display maps or images obtained from external sources, as well as to the capability of the IMS to display the results of user queries in the form of a map;
- Be accessible via Internet, and available 24/7 at 95%; this implies that the system host ensures the availability of around-the-clock personnel, an adequate back up scheme (hardware, contents) and mirror sites in other physical locations;
- Provide functionality for management and testing of the IMS, including of the metadata scheme; this will be a function for the IMS Administrator, in order to ensure the proper performance of the IMS; the tasks of the IMS Administrator will be defined separately;
- Ensure the privacy of the users of IMS, through strict user verification, properly defined access rights to the contents of the IMS, and other protection measures to avoid unwanted external access to the information and to the activities carried out within the IMS, such as searches and queries, which could have a strategic value;
- Provide quality control of the inputs/updates of the meta database (references); inputs/updates of selected subdivisions of the meta database can be made by identified experts in the various countries, the remaining part of the meta database is updated by the IMS Administrator; the input/update process will include a rigid quality control scheme using predefined forms and formats; the user has access to an extensive help function and to look-up lists (thesaurus) for specific fields;
- Provide facilities to set access rights for individuals and by groups; different categories of users will have different rights; all users need to register and registered users obtain read-only rights; selected recognized users can obtain rights to input new information in specific parts of the meta database or update existing information in these parts; it may be necessary to limit access to certain parts of the meta database to certain user groups;

- Provide facilities to define standard queries and generate a standard, predefined report with the query results; this implies the functionality to define and store a query for later use, and to define and store the format or layout of a report on the results of the query;
- Facilitate the generation of a periodic publication on the status of ecosystems and environment of the CLME+ region; this implies the definition and storage of the corresponding queries, the compilation of the results of the queries (links), the collection of information from these links and the formatting of this information into a comprehensive layout; probably an Expert Panel from the region will be responsible for this publication;
- Provide a facility to generate a periodic dump of selected data and information referred to by the IMS on digital storage media (CD/DVD); this is especially relevant for those involved in CLME who have insufficient access to the Internet.
- Provide facilities for members of the CLME community to identify, connect, and associate within and across common groupings, in order to discuss and to exchange information and experiences. In this sense the IMS serves to facilitate the building of partnerships needed for an effective governance network in the region, inter alia by providing reference information on existing groupings relevant for CLME.

5. IMS PROTOTYPE (BETA VERSION)

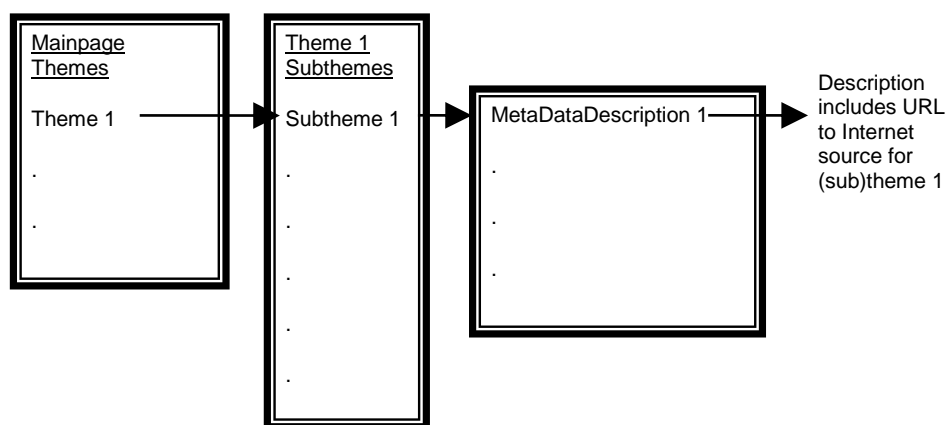
On the basis of the previously mentioned Terms of Reference, four parties were invited to tender: MARIS from The Netherlands, GCFI and Virginia Institute of Marine Sciences from USA, and COIN Atlantic from Canada. Finally from the offers received, the Gulf and Caribbean Fisheries Institute, GCFI, from Marathon, USA, was selected to carry out the development and implementation of the IMS. An important reason for this selection was the broad experience of GCFI with online data, information and knowledge management, and its position in close relation with the fisheries communities of the Gulf of Mexico and the Caribbean.

The beta version of IMS (<http://clmeims.gcfi.org/>), operational since October 2012, has been developed to cater for a broad range of information, and for this reason includes an advanced metadata mapping and search system (Drupal), which allows for complex queries through a relatively simple user interface. To date the prototype IMS covers about 300 potential sources of data and information and includes references to about 400 publications. The currently included themes were chosen to correspond to the Terms of Reference and moreover are based upon suggestions from the user community, including from the CLME stakeholders. Care was taken to include references to information on the issues defined by the 3 x 3 (4) matrix, on the 5 LME modules, and on the GEF/LME indicators. The current broad panorama of themes serves to demonstrate the system's functionality and flexibility:

Biodiversity Organisations	42 Additional Assessments
CRFM Fisheries Publications	Economic Valuation Bibliography (English and Spanish)
Data Sources	Spiny Lobster Management
Monitoring Programs	Indicators (3 x 3(4) matrix)
Fora and other groupings	Ocean Data (IOC)
SAP Implementation	Ocean Expert (IOC)
Sources of Traditional Information	Ocean Docs (IOC)
Regional Agreements	
GRAMED Assessments	

Upon suggestions from the CLME community, additional themes are under preparation, such as NODC's in the region, Environmental and Ecosystem Monitoring (technologies and methodologies), Integrated Coastal Zone Management (outcome of pilot project), Funding Opportunities, Ongoing Projects in the region, and Invasive Species.

In order to fully profit from the contents of the IMS, it is important to understand the internal structure of the system. As mentioned above, the IMS is grouped around a number of themes. For some themes, due to their special character, several subthemes were defined. Each theme (or subtheme) refers to a table (rows and columns) of which the records contain the metadata description of a source of data of information pertaining to the corresponding (sub)theme. Besides descriptive text, the metadata description contains a link to a site in Internet (URL). Schematically, this looks as follows:



The advanced search engine Drupal allows for complex text searches, including Boolean operators¹, either through all metadata contents of the IMS or focused only within metadata on specific themes or on specific issues. While IMS primarily displays the results of searches as text or tables, it also offers the possibility to present the search results in a graphical, map-based manner (the IMS GIS project). Of course this implies that the providers of the metadata included location information in their metadata contributions.

The fact that the contents of the IMS are dedicated and focused upon the needs and relevant themes of the CLME project, makes the search results of IMS more applicable for the users than in the case of using Google. However as an additional feature, the IMS allows carrying out searches with Google; it should be noted that in this case the search results will be less focused, and the privacy of the user and his search actions cannot be guaranteed. The IMS also includes in principle the technical possibility to search in other databases, such as CMA and OBIS, for which these external databases must be provided with the necessary interface; this is planned to be implemented in the near future.

Because of the cultural and linguistic diversity of the CLME+ region, one major issue for an effective IMS is language. Careful consideration was given to this aspect during the IMS design and development phase. The current beta version of the IMS includes a user interface in English and in Spanish, and user manuals for IMS are available in both languages and in various formats on the IMS main page. An online translator facility is being considered for implementation at a later stage.

Initially users needed an account to access the beta version of IMS. This was done to ensure a maximum privacy and protection of the users, their search actions and the contents of the

¹ Boolean operators: logical combinations of search arguments such as AND, OR, and NOT.

IMS database. However upon request of the CLME PCU this approach was abandoned and now any user can access the IMS, but only for searches. Users-providers who wish to edit existing information or add new information still need to apply for a special user account allowing for these actions. Meanwhile the IMS maintains a detailed statistics of the usage of the system.

6. IMS AND THE 3 x 3 MATRIX

Indicators are essential tools for decision makers and governance. In the context of the CLME, indicators not only monitor the environment, ecosystems and related issues, but also act to monitor the impacts of the proposed strategies, interventions and actions of the SAP. One of the main purposes of the IMS therefore is to support the development of suitable indicators for decision making, providing references to the data and information required to generate these indicators.

The IMS provides a functionality to easily access data and information sources required to generate indicators for the main problem areas identified for CLME (habitat change, contamination and overfishing), and the three major fisheries sectors (coastal, reef and pelagic). On the main page of the IMS, the key "Indicators" presents the user with a slightly adapted version, the 3 x 3 (4) matrix, which not only includes the initially identified three fisheries sectors and three problem areas, but adds one more problem area: climate change.

On the basis of the results and recommendations of the Workshop on Indicators for Decision Making, and subsequent work by a contracted expert, the IMS was filled with metadata references to sources of data and information required to generate the indicators corresponding to each of the cross points.

Indicators table

		Sector		
		Reefs	Coastal Zone	Pelagic
P r o b l e m	Contamination	Indicators	Indicators	Indicators
	Change of Habitat	Indicators	Indicators	Indicators
	Over-exploitation	Indicators	Indicators	Indicators
	Climate Change	Indicators	Indicators	Indicators

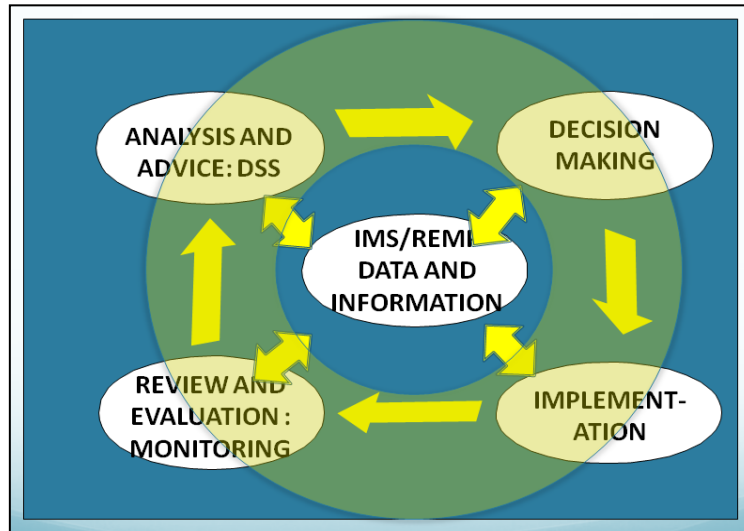
At this point, the IMS informs the user as follows:

"Indicators can help to inform citizens, policy-makers, scientists and other stakeholders about the status of marine resources, human impacts on the marine ecosystem, the effects of mitigating actions, and the roles and responsibilities of stakeholders. The Indicators component of the IMS is meant to foster information among those institutions and users developing and applying marine indicators. As such this knowledge base will help: to improve understanding of marine indicators and their uses, to promote data and information sharing, and to encourage communication between and among indicator developers and users. Each

button in the table above provides direct links to numerous sources of data and information related to indicators, structured along the 3 x 3(4) matrix of the CLME project.”

Clicking on an “Indicators” tab in the matrix leads the user to a list of suggested state, stress reduction and process indicators corresponding to his choice, e.g. Contamination and Coastal Zone. That same list then provides references (links) to the relevant sources of data and information needed to generate the indicators required.

7. IMS/REMP UNDERPINNING THE POLICY CYCLE

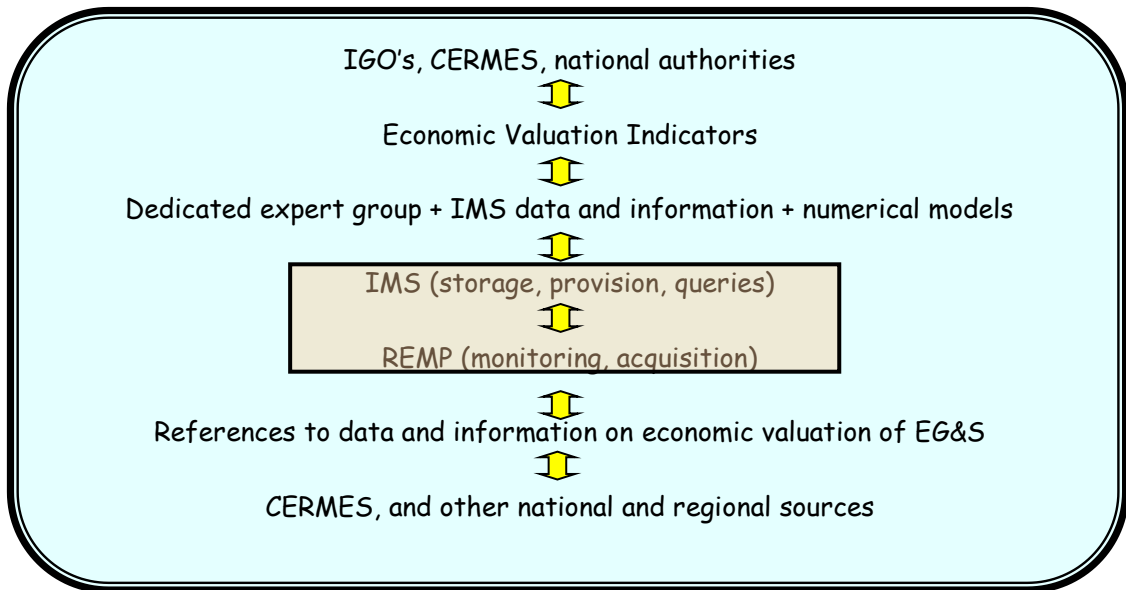


As indicated in the diagram, the data and information mechanism IMS/REMP actively supports and closely interacts with the different phases of the decision making process: the policy cycle. In each of the phases, IMS/REMP provides dedicated references to data and information sources relevant for that specific phase. Meanwhile, the IMS/REMP collects and stores information on the proceedings and results of the process, as a reference for the future. This is a learning capability of the system allowing for an adaptive management approach, improving the quality of the decision making process over time.

While developing and implementing the IMS/REMP, three pilots were carried out to provide a prototype demonstration of how this mechanism works: for the Management of the Spiny Lobster Resource with the team of the Spiny Lobster pilot project of OSPESCA, for Economic Valuation of Ecosystem-based Goods and Services (EG&S) with CERMES, and for Integrated Coastal Area Management, carried out in collaboration with the Barbados Coastal Zone Management Unit. The results of each of these pilot projects are briefly presented below and have been included in the IMS.

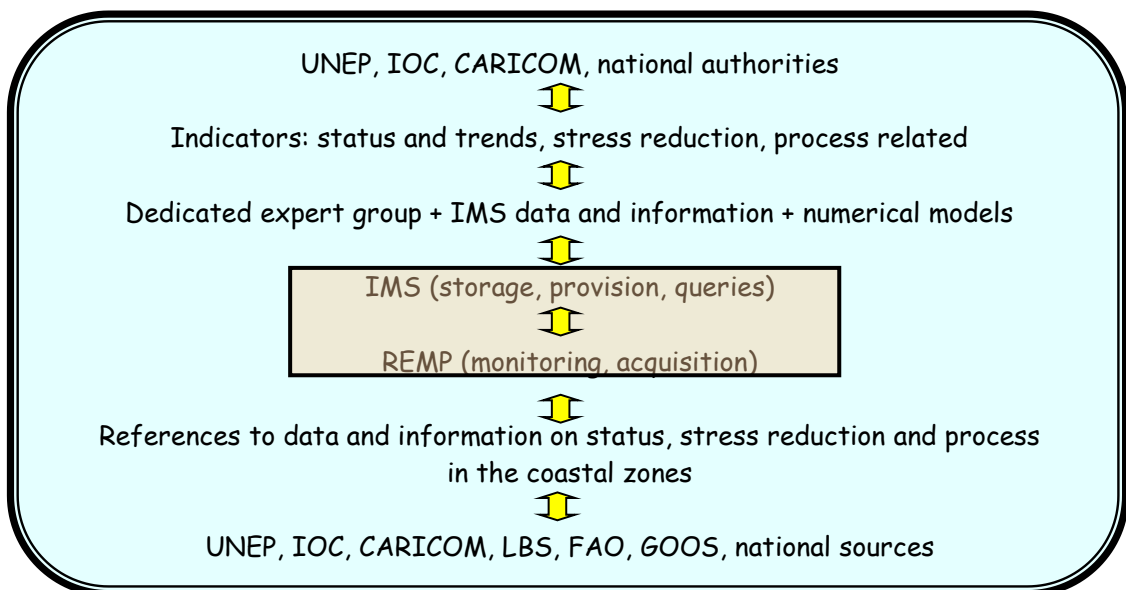
As an example for the case of the Spiny Lobster Pilot Project (refer to above diagram): in the Decision-Making phase, information on the present stock of the resource and the impacts of previous measures is localized through the IMS. Then a decision is taken, e.g. on a renewed ban on catches, which is then transmitted to the participating countries for implementation. In this Implementation phase the countries can consult the IMS e.g. on the availability of appropriate promotional material, and on recommended supporting actions. Subsequently the implementation is verified and monitored, and references to the process and the results are included in the IMS. Meanwhile also the stocks of the resource are monitored and references to this information are included in the IMS as well. Then in the Analysis and Advice phase, all available information on the actions undertaken and their impacts is consulted and on this basis new advice is provided to the decision makers, thus closing the cycle.

For the case of Economic Valuation of ecosystem based goods and services, the following diagram is an alternative way to present the various steps of the process.



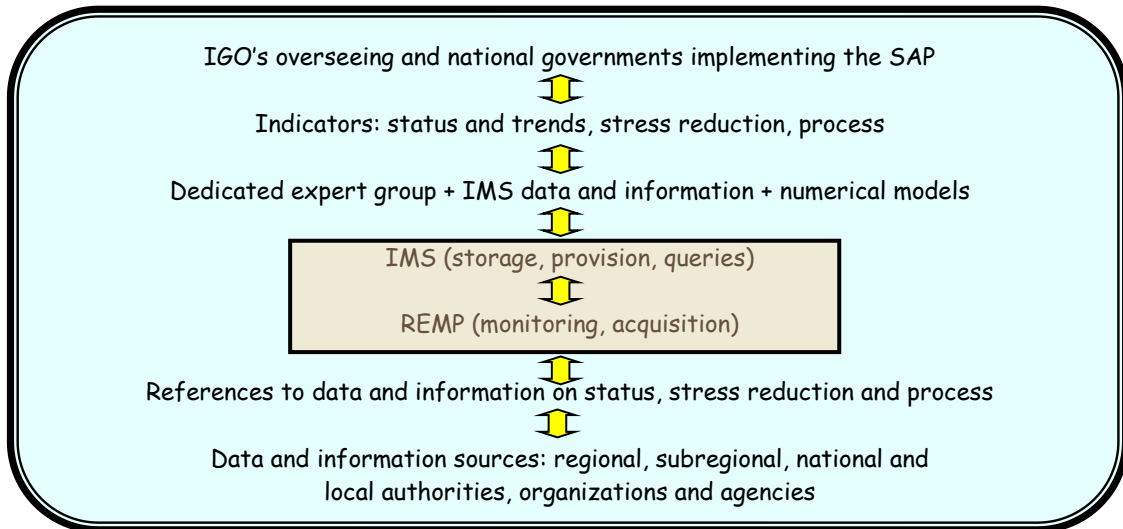
In order to respond to a specific policy issue, involving economic valuation, a dedicated expert group is charged to provide the relevant indicators to the decision-making process. The group refers to the IMS/REMP combination to get access to relevant data and information on economic valuation, as provided by CERMES and other sources in the region. This data and information is then used to generate the corresponding Economic Valuation Indicators to the requester.

In a similar way, for the pilot project on Integrated Coastal Area Management, the following diagram illustrates the data and information flows from the sources to the users.



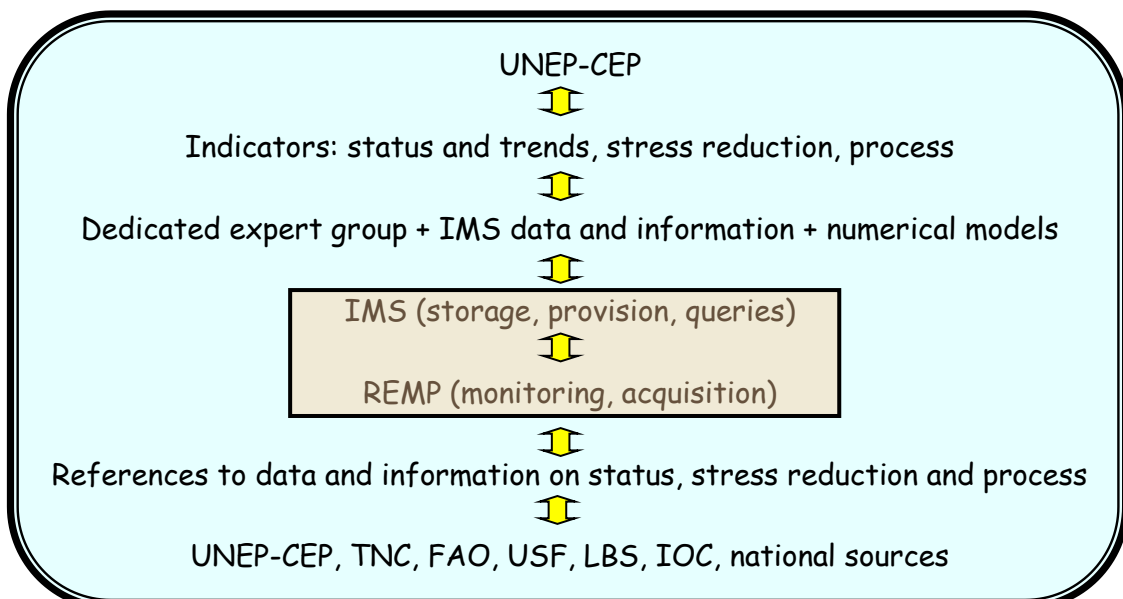
8. IMS/REMP UNDERPINNING THE SAP STRATEGIES

The diagram used in the previous paragraph, can be used to show the location and function of the IMS/REMP in the data and information flows from providers to users, underpinning the strategies, interventions and actions proposed by the SAP, through dedicated indicators.

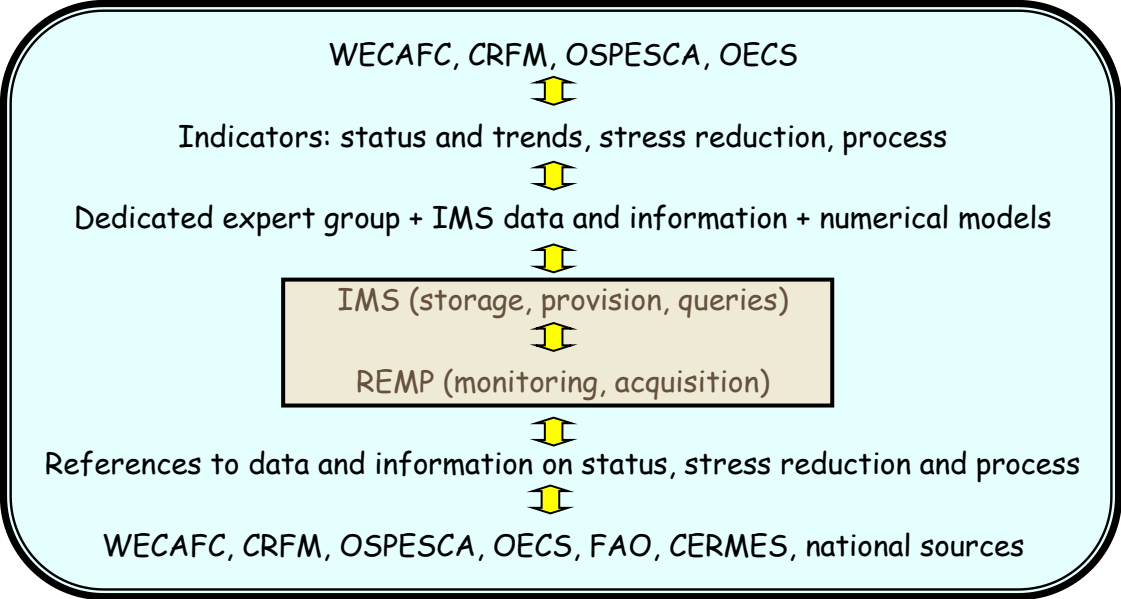


For each strategy, the diagram presents the specific sources and holders of data and information (bottom) and the users of the condensed information (top). It depicts the specific key role of IMS/REMP as metadata directory, as well as the role of dedicated groups of experts for assessment of the available data and information, the formulation of decision-making advice and the generation of the required condensed information in the form of indicators.

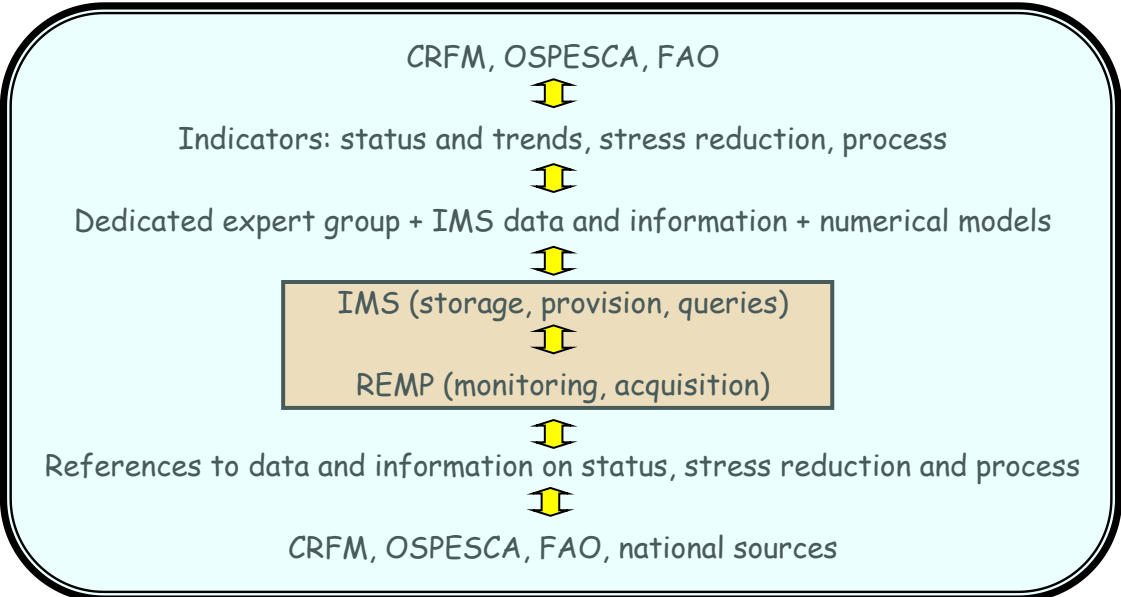
SAP Strategy 1: Enhance the regional governance arrangements for the protection of the marine environment.



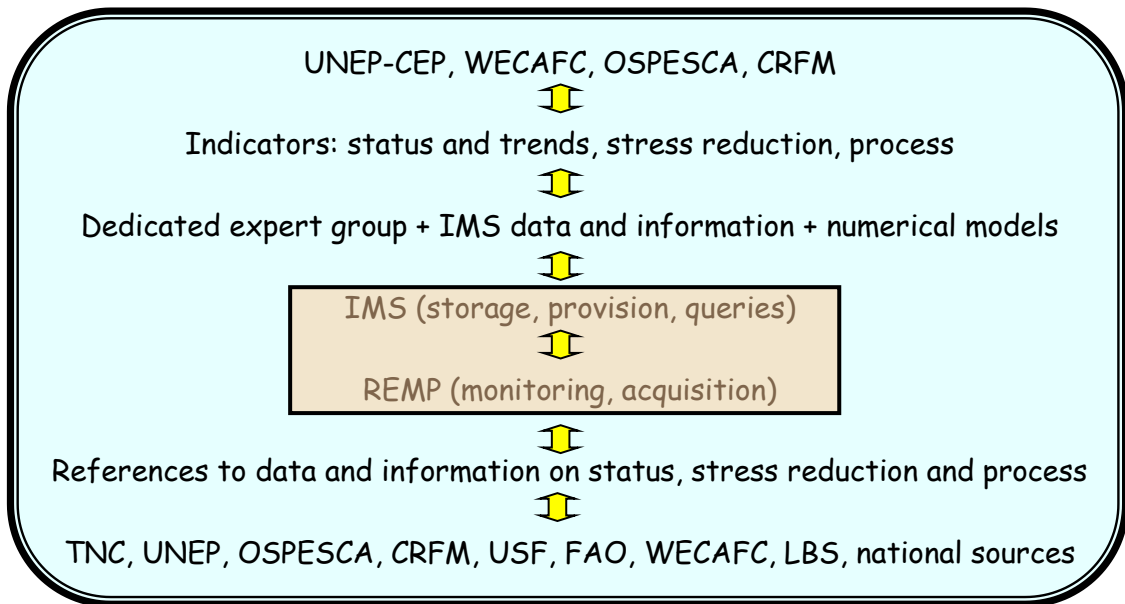
SAP Strategy 2: Enhance the regional governance arrangements for sustainable fisheries



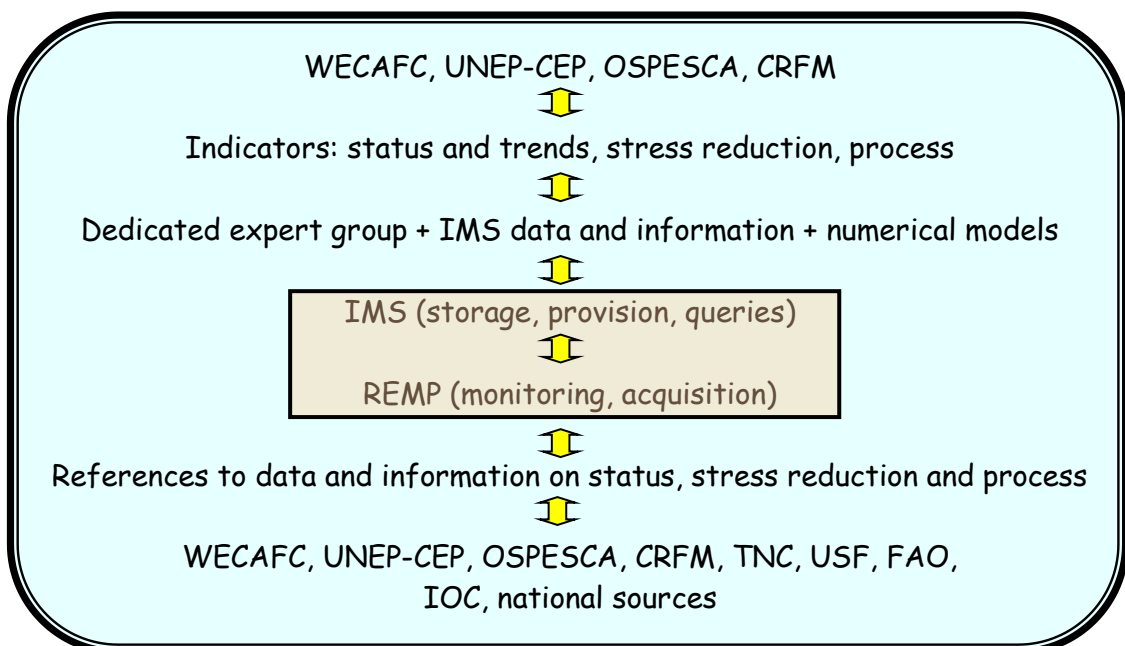
SAP Strategy 3: Establish and operationalise a regional policy coordination mechanism for ocean governance with initial focus on shared living marine resources



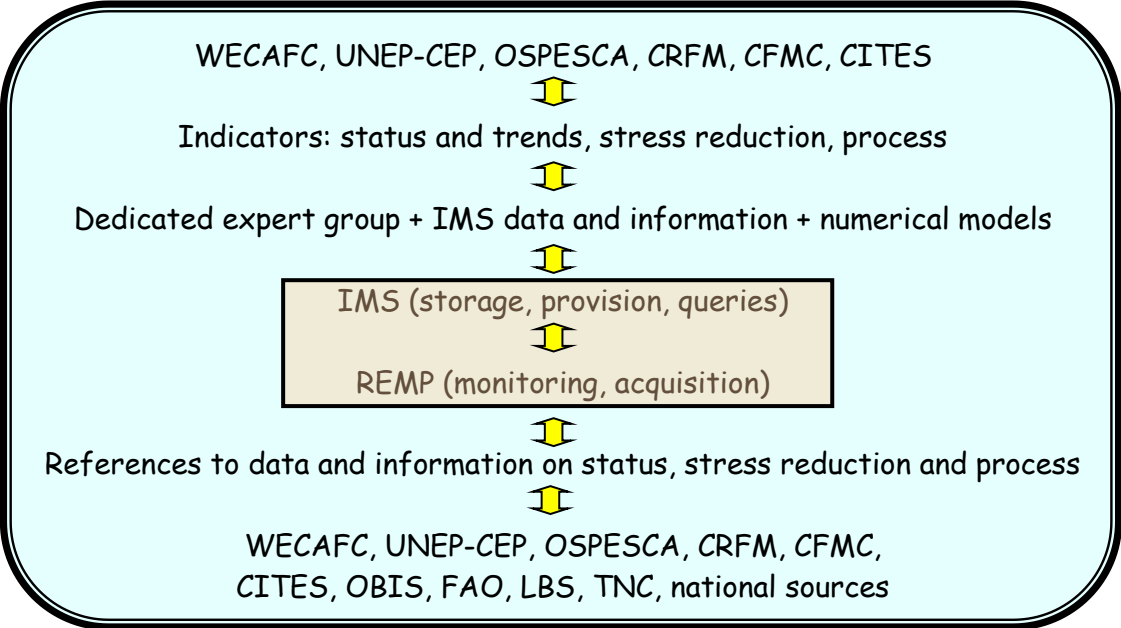
SAP Strategy 4: Enhance the governance arrangements for ecosystem-based management of reefs and associated ecosystems (e.g. seagrass beds, mangroves, reef slopes and coastal lagoons)



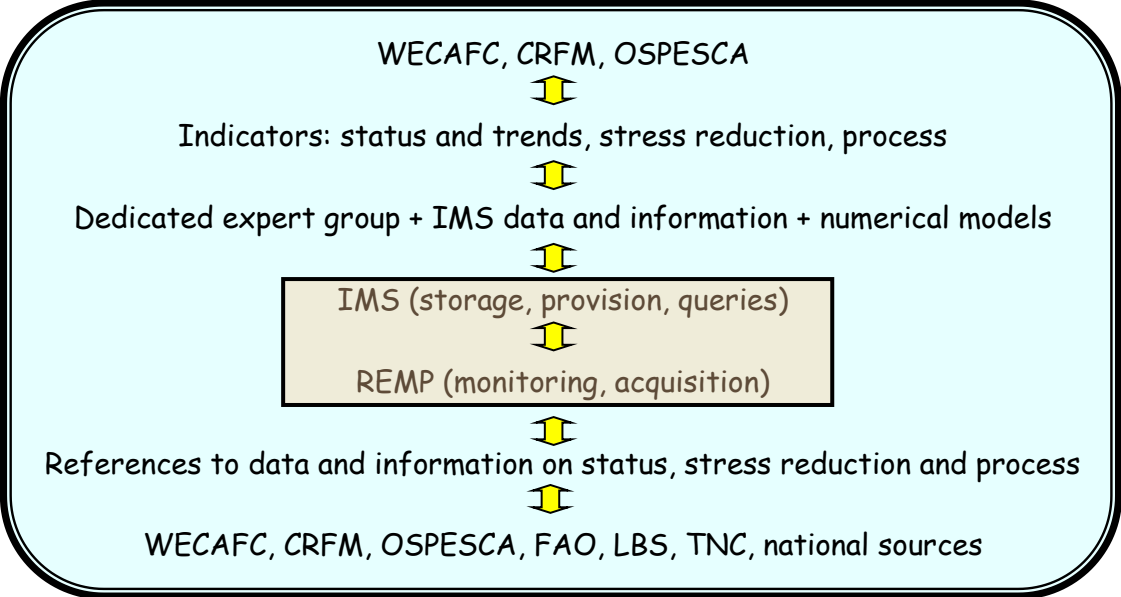
SAP Sub-Strategy 4A: Enhance the governance arrangements for implementing an ecosystems approach for spiny lobster fisheries



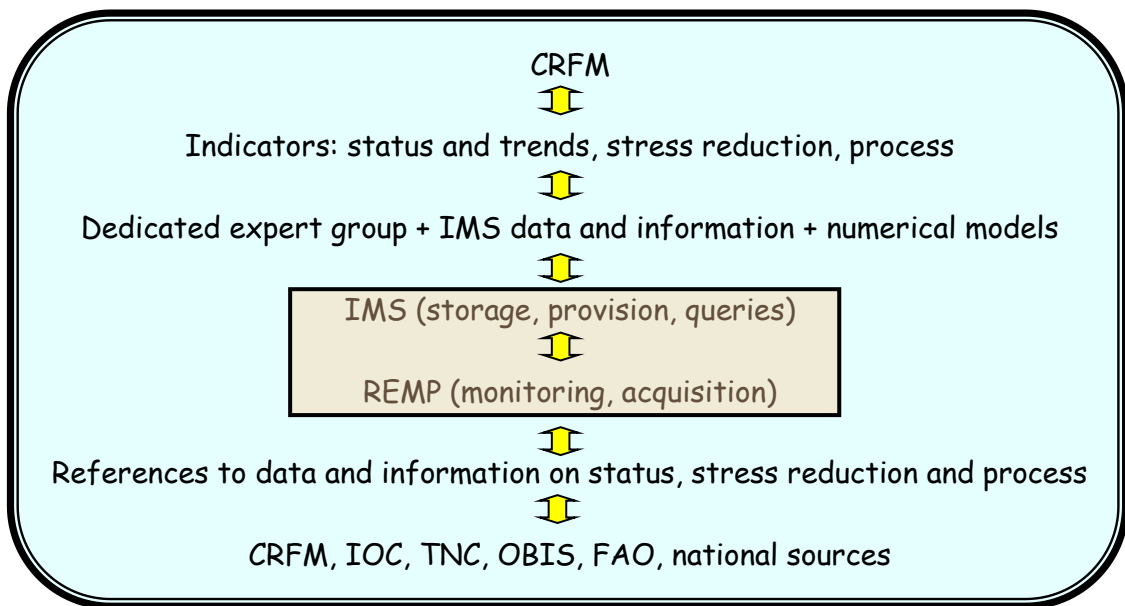
Sub-Strategy 4B: Enhance the governance arrangements for implementing an ecosystem approach for the queen conch fisheries



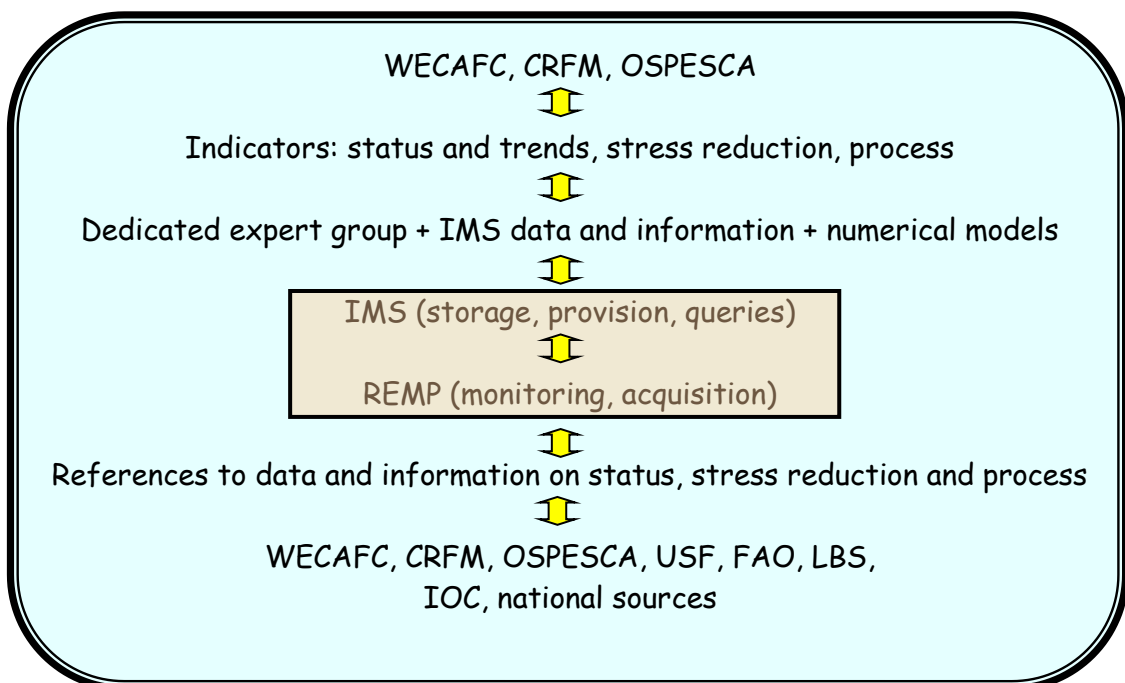
Strategy 5: "Enhance the governance arrangements for implementing an ecosystem approach for pelagic fisheries"



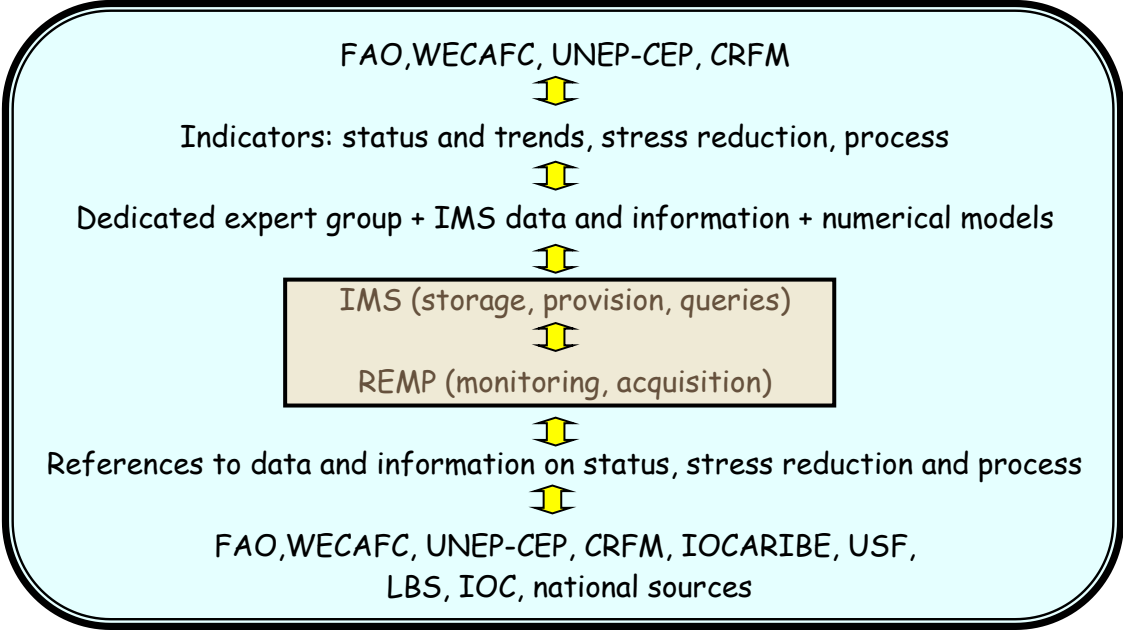
Sub-strategy 5A: Enhance the governance arrangements for implementing an ecosystem approach for flyingfish fisheries



Sub-strategy 5B: Enhance the governance arrangements for implementing an ecosystem approach for large pelagic fisheries



Strategy 6: "Establish governance arrangements for implementing ecosystem-based management of the Guianas-Brazil continental shelf"



9. DATA POLICY

Throughout the region, there is a considerable interest in ecosystem and environment data and information, not only from decision-makers but also from other users (science, management, private sector). However, at the same time strong reservations exist in the region with respect to free and open sharing of data and information. This relates to a combination of interests from individual to national. As a consequence, decision-making cannot always rely on the best data available, which impacts upon the quality of the decision-making process and consequently of the resulting decisions.

As a first step towards resolving this problem and in the context of the IMS/REMP project, a draft for a CLME regional data policy has been developed in the framework of a study on legal aspects by Black Holes, the Netherlands. This draft takes into account existing data policies, such as the data policies of UNESCO-IOC, ICES, GBIF, and WMO, and the INSPIRE² Directive and the Aarhus Convention³ in Europe.

The objective of the proposed data policy is to improve the availability of the required data and information to the decision making process while at the same time protecting the rights of the providers and their organizations, as well as the respective national interests. The complete results of the study on the legal aspects are available as a separate report (deliverable D.3.6), which includes the proposal for a draft CLME Data Policy. Below follows a summary of the results of the study.

² INSPIRE Directive: Infrastructure for Spatial Information in Europe

³ Aarhus Convention: establishes a number of rights of the public (individuals and their associations) with regard to the environment.

From the perspective of CLME it is important to establish an entity for the purpose of running a CLME database, depository or portal in a state with the national copyright law considered most suitable for the purposes of CLME. This would presumably mean a state where also electronic data would be covered by such a regime, in order to obtain the desired level of copyright, hence control, over the data and their use further downstream. The almost world-wide recognition and hence application of copyright once duly established in one country by way of the international treaties referred to will then to a large extent cause the protection to be valid in most other countries as well.

In this context it is further recommended to consider the establishment of a region-wide inventory of data holdings, as an approach towards not only centrally storing reference information (metadata) for all relevant data and for regulating access, but also to monitor whether the legal consequences and parameters of the several categories of data at issue from a legal perspective would appropriately be respected. Especially in the case of digital data, software tools might be developed and applied to facilitate this process.

With respect to the issue of metadata, it may be interesting to note that the INSPIRE Directive in Europe mentioned earlier does provide for a specific set of requirements for member states to ensure metadata are widely, easily and to a certain extent even freely available, in order to generate maximum visibility, accessibility and user-friendliness once certain datasets are found to have come within its sway.

As the CLME project intends to, inter alia, give rise to a number of agreements and commitments, it may be helpful for further guidance to realize that within the EU context legislation has been enunciated which, with specific focus on environmental issues, requires of member states to take a number of measures and undertake certain commitments to ensure in practice widespread, free and easy access to those data, notably through the INSPIRE Directive and the Aarhus Convention.

In order to ensure the availability of actual, complete and reliable data for decision-making and governance, it is also recommended to consider the creation in the CLME region of an operational monitoring mechanism, solely dedicated to provide reliable data and information on ecosystems and environment, as a basis for governance, and without the usual access and other limitations of data access generated by the academic world.

It would be advisable to draft appropriate disclaimers of liability with regard to damage potentially resulting from the use of erroneous data in the context of CLME, either – to the extent data may be offered freely and openly, for example on a website – on that same website in a manner that no one could overlook it, or – to the extent data would be offered only to specific users under copyright licenses or other usage-related contracts – by way of clauses in such licenses respectively contracts.

10. INDICATORS FOR DECISION MAKING

In order to make decisions, decision-making requires information. First of all, this information needs to be the best information available. But additionally, the information needs to be in a convenient form in order to be manageable by decision-makers: so-called indicators. These indicators can be of many kinds but usually three main categories can be distinguished:

- indicators that relate to a process, usually at organizational level, such as the reorganization of a Ministry or the establishment of an inter-sectorial committee; in this case the value of the indicator indicates with a simple yes or no, whether the required process was implemented and completed; sometimes the process is

subdivided in phases and the indicator indicates in which phase the process is; note that the indicator only shows the implementation and completion of the process, it does not show whether or not the foreseen results of the process were achieved. Process indicators are obtained through a monitoring and reporting mechanism specifically established to monitor the relevant processes, and periodically report on their development and status.

- indicators of stress reduction, usually relating to measures taken, for example in the form of the number of protected areas established or the number of square km's of mangroves replanted for coastal stabilisation and protection. Stress reduction indicators are based upon information obtained from the relevant authorities in a country, usually Ministries. The adequate use of these indicators requires the definition of the measures to be periodically monitored and of the value to be shown by the indicator (number, square km's ...).
- indicators of the actual state of ecosystems and environment, such as for instance the condition of coastal waters or of ground water resources, and the state of the biodiversity; in this case the value of the indicator can be represented as sort of traffic light: red for bad and green for good; obviously this requires unambiguous criteria to be defined under what conditions the indicator should be either green or red; moreover, in many situations a third and fourth colour are used to represent trends, for instance orange for improving and yellow for deteriorating. In these cases, suitable historical data needs to be available in order to determine the corresponding changes over time. Indicators of the actual state of ecosystems and environment need to be based upon adequate data and information: updated, complete and reliable. Such data and information can be obtained through a well-defined monitoring process using periodic measurements and observations carried out with the same technology and methodology at the same spot for an extended period of time. In addition, scientific knowledge and understanding are required as input to define the conditions for good or bad, and understand the relevant processes and interactions.

A broad expert consultation on suitable indicators for decision-making within CLME resulted in a series of proposals for process, stress reduction and state indicators. The detailed proposals and the considerations that led to their formulation are included in deliverable D.2.2). The choice for the proposed indicators was made on the basis of the experience of the experts, and emphasising the need for harmonised procedures for monitoring ecosystems, environment and socio-economic issues.

A further analysis and selection of these proposals was made in order to facilitate the inclusion of indicators in the IMS according to the priority issues and fisheries sectors for CLME (the 3 x 3(4) matrix). The results of this analysis and selection in the form of a theme in IMS are presented elsewhere in this report, while details on the considerations are included in deliverable D.2.2.

The main requirement of the decision-making process relates to the future: what changes are to be expected in the (near) future? what could be the impact of a specific decision or measure? This implies the need for forecasts and simulations, based upon models of the ecosystem and the environment. As tools for decision-making, these models need to be based upon understanding of system dynamics and predictability, and should emerge from studies of "complex systems". Over recent years, a range of relevant modelling techniques has become available through advances in computer speed and accessibility, and by implementing a broad, interdisciplinary, "holistic" systems view.

Indicators should be included in a regional strategy of decision-making aimed at achieving ecosystem sustainability, and be based upon national strategies or policies that clearly define objectives, criteria and priorities on the road to the desired ecosystem sustainability. For such strategies to be successful it is essential that not only they are supported by government entities, but also have a strong platform in private industry, the scientific community and amongst the population.

In this context it is interesting to note the following proposals for composite indicators, especially to be used in the context of environmental sustainability. Some of these might be applicable in the context of CLME:

- Ocean Health Index (OHI) is a comprehensive new measure that scores ocean health on a scale from 0-100. Evaluated globally and by country, these 10 public goals measure benefits that a healthy ocean provides to people. Both overall scores and individual goal scores are directly comparable among all countries. Each goal score reflects the current status and its likely future status (~5 year). Likely future status includes the trend of status scores for the most recent ~5 years, the pressures that negatively impact the status, and the resilience factors that may improve it. The scores reveal what is working and what needs attention, with higher scores indicating more successful and sustainable achievement of goals.
- Environmental Sustainability Index (ESI) is published by the World Economic Forum. It is a measure of the overall progress towards environmental sustainability, developed for 142 countries. The ESI scores are based upon a set of 20 core indicators each of which combines two to eight variables for a total of 68 underlying variables. The ESI permits cross-national comparisons of environmental progress in a systematic and quantitative fashion. It represents a first step towards a more analytically driven approach to environmental decision making.
- The European Union's Joint Research Center in Ispra developed the Dashboard of Sustainability (DS) as a software programme which allows presenting complex relationships between economic, social and environmental issues in a highly communicative format aimed at decision-makers and citizens interested in sustainable development. For the WSSD, the CGSDI (Consultative Group on Sustainable Development Indicators) published the "From Rio to Jo'burg" Dashboard, with over 60 indicators for more than 200 countries – a tool for elaborating assessments of 10 years since the Rio Summit.
- Wellbeing index (WI) combines 36 indicators of health, population, wealth, education, communication, freedom, peace, crime, and equity into the Human Wellbeing index, and 51 indicators of land, biodiversity, water quality and supply, air quality and global atmosphere, and energy and resource use pressures into an Ecosystem Wellbeing index. The two indexes are then combined into the Wellbeing/Stress Index.
- Ecological footprint (EF) of a specified population can be defined as the area of ecologically productive land needed to maintain its current consumption patterns and absorb its wastes with the prevailing technology. People consume resources from all over the world, so their footprint can be thought of as a sum of these areas, wherever on the planet they are located.
- Living planet index (LPI) is an indicator promoted by the World Wildlife Fund. It tries to assess the overall state of the Earth's natural ecosystems, which includes national and global data on human pressures on natural ecosystems arising from the consumption of natural resources and the effects of pollution.

- Eurostat's Material Flow Indicators are based on economy-wide material flow analysis, which quantifies physical exchange between the national economy, the environment and foreign economies on the basis of total material mass flowing across the boundaries of the national economy. Material inputs into the economy consist primarily of extracted raw materials and produced biomass that has entered the economic system (this biomass is composed of, for example, harvested crops and wood). Material outputs consist primarily of emissions to air and water, land filled wastes and dissipative uses of materials (e.g. fertilizers, pesticides and solvents).
- The Direct Material Consumption (DMC) indicator is defined as a sum of all domestic extraction flows (extracted raw material, harvested biomass, etc.) including imported and excluding exported material flows (raw materials, biomass and semi-manufactured/manufactured products).
- The Human Development Index (HDI) of UNDP is a composite statistic of life expectancy, education, and income indices used to rank countries into four tiers of human development. It is a simple composite measure of human development intended to convince the public, academics, and policy-makers that they can and should evaluate development not only by economic advances but also improvements in human well-being.

While several of these indicators are available through the Internet, it is not always easy to determine what data and information were used to generate them. This uncertainty complicates their applicability for real-life operational decision-making. Moreover, most of these indicators relate to rather large regions, while the problems impacting upon the fisheries communities of the CLME+ region are often rather local and therefore hardly appear in these indicators.

For successful and operational decision-making it is essential to have monitoring and reporting programmes in place that produce the necessary data and information (and knowledge) to generate indicators at the relevant scales. Particularly this refers to the actual state of the ecosystems and environment and moreover to their history, which allows for future trends (changes) to be identified. In that way the results of interventions, actions and measures can be evaluated (the SAP), as well as the effects of important phenomena such as of climate change.

11. PROMOTION AND AWARENESS

During an expert consultation with representatives from the CLME+ countries and experts on issues related to data and information management, the IMS/REMP and its various functions were demonstrated and assessed. In this context it was emphasised by the experts that the successful performance of the IMS in support of regional governance, requires a well-organised data and information management in each of the CLME+ countries and its relevant institutions. This implies having a full chain process active from the monitoring of ecosystems and environment via quality control, analysis and archival of data and information, to provision of indicators to the decision-making process. According to the experts, special attention should be given to the establishment of a regional baseline of historical data and information, and to the regional harmonization of the procedures of the data and information chain, in order to make the final results for decision-making (the indicators) comparable and compatible.

A full report of this expert consultation is available as deliverable D.4.2.

Main observations and conclusions from the consultation include:

- A well-organised data and information management in each of the CLME+ countries and its relevant institutions is essential for CLME and adequate regional governance. Initiatives need therefore to be taken to increase capacity at all levels on data and information management.
- In the further development of IMS, the issue of language will have to be considered. A standard list of Latin names needs to be included to facilitate species-specific searches.
- IMS/REMP should include more contributions from the fishing community, thus making the IMS more useful for this community.
- Although over the years much information has been carefully and systematically gathered in the region, it is apparently still a big challenge to share, manage and properly organize this information. In this context it is recommended that IMS/REMP initiate and support projects aimed at data rescue, the salvage of historical data sets, which is important for the baseline and for the generation of indicators.
- A mechanism should be established to facilitate the exchange of ideas and experiences related to data and information management, and to increase the involvement of the community with IMS/REMP.

12. CAPACITY BUILDING

One of the objectives of the IMS/REMP component of CLME is to assist the CLME countries with strengthening their data and information management. In this context, IMS/REMP assisted CRFM, and in particular Jamaica and Bahamas, with a consultancy related to problems with the existing software system for management of fisheries related data and information. A separate report on this consultancy is available as D.3.7.1.

As an outcome of the consultancy, it was recommended to refrain from further use of the software, in view of its unreliable performance, and to initiate the development of a new fisheries database software compatible with current operating systems and meeting the current and foreseeable requirements of the users. Also it was highly recommended to carry out a consistency check on the fisheries database contents, after export to other formats.

It was further noted that besides the actual fisheries database, still much data and information is being archived in analogue/printed form. Moreover, it was confirmed that the access to this distributed information is not always easy, as a consequence the institution does not optimally profit from its in-house information. Neither of the two organizations have general institutional procedures or protocols in place for the internal management of their data and information, both digital and analogue. It was therefore recommended to develop and implement a set of institutional procedures or protocols for the management of data and information. It should be considered to propose the development and implementation of similar procedures or protocols in CRFM related institutions in other countries in order to strengthen the provision of data and information to CRFM and for instance also to IMS.

Another recommendation resulting from this consultancy, relates to the need for training of the relevant personnel on data and information management issues. This would include: data and information processes, quality control aspects, protection and vulnerability, metadata and "search and find", data organization, and data archive management. Additional training will be needed when a new system for fisheries information is

implemented. Finally it was recommended to involve the long-standing experience of IOC and IODE with various technical aspects of marine data and information management, and with the related capacity building. In the context of the consultancy, a basic training on data and information management, and on relational data bases, was provided to the relevant personnel of both visited agencies.

Also it was recommended to upgrade the hardware environment in both institutions, including the provision of UPS facilities, at least for the computers linked to the fisheries database. Precise numbers of equipment need to be determined in a closer review.

Furthermore it was recommended to develop and implement digitizing projects, meant to convert valuable data and information which is still in analogue (printed) form, to a digital form, facilitating its access and use. This recommendation corresponds to a recommendation made by the IMS/REMP Promotion and Awareness workshop.

13. REMP GRADUAL DEVELOPMENT

As specified by the Inception Meeting, the goal of the REMP is, through a continuous monitoring process, acquire data and provide information on the current state and changes in the Caribbean ecosystems and environment, in order to support assessment of the ecological integrity and sustainability of marine resources of the region.

The development of the Regional Environmental Monitoring Programme, REMP, needs to match the institutional capacity and the levels of funding available in the region. Moreover, it was expected by the Inception Meeting that the development of a complete and sustainable REMP to fully track the ecological and environmental integrity and sustainability of the marine resources in the Wider Caribbean will require years to build. However, valuable national components of such a future regional monitoring programme already are in place, such as in Colombia (INVEMAR, DIMAR) and Barbados (BCZMU).

As a first step, the REMP development would therefore consider data and information on critical transboundary issues, in order to enable the production of consistent, comparable results in support of the decision making process at the national, sub-regional and regional levels, and of the implementation of the SAP. The current version of REMP precisely meets these requirements. However, it should be noted that the problems facing the local fishing communities are mostly of a local character (contamination, habitat change, overfishing) and often do not show up in regional assessments. Therefore, it seems important to extend the scope of the REMP with local information from national sources, including the local fishing communities themselves.

Through presentations at various meetings and through personal communications, the CLME community has been made aware of the IMS/REMP in the context of a regional awareness and capacity building programme. Based upon the feedback from these communications, the current beta version of IMS was developed and implemented. This consultative process will need to be further developed and intensified, as participatory and as inclusive as possible. This effort is expected to further expand the regional network of contacts, willing and able to contribute (metadata) information to REMP on relevant issues. These efforts initially will concentrate on the themes included in the IMS, as well as on the monitoring of the implementation of the proposed SAP strategies.

In this context it should be mentioned that the CLME region urgently needs an updated baseline reference on ecosystems, environment and related issues: currently this baseline is far from complete and updated, complicating decision making and governance. Until now, data on ecosystems and environment in the region has mostly been collected through

scientific research projects of limited duration and scope. In addition, very few monitoring programmes cover the whole region and often they do not apply strictly standardized methods for measurements and observations.

Moreover, there is a limited awareness on the importance of commitments to long-term management of data and information archives, while many countries are still in the process of changing from paper to digital formats, a process hampered by the lack of capacity (funds, trained manpower). Furthermore, institutions often do not have an institutional protocol for the handling of data and information. This implies that the oversight of the data and information within the institution is lost, the data and information is not profited from to the full, and chances are that data and information are even being lost inadvertently.

14. UPDATING THE IMS

In order to realize an optimum support for decision making, the information in the IMS needs to be managed, maintained and regularly updated. This can be achieved either in a centralized or a decentralized mode; the current concept of the IMS aims at a mainly decentralized management of the metadata, following the subsidiarity principle. As a result the cost of sustaining the total system can be distributed over various committed providers, and as a central cost remains only the central management of the IMS, mostly covering the technical aspects and new developments of functionality where needed.

Various organisations in the region already have indicated their willingness to participate in a decentralized effort to manage and update specific contents of the IMS. It is expected that more providers will be found willing to join this group, especially amongst the main stakeholders of the CLME project. Moreover, a major role in this context could be played by the regional network of "national data and information coordination committees." As required, a draft for an agreement to such effect was developed and is available as part of deliverable D.3.6.

15. ADDITIONAL DATA AND INFORMATION ISSUES

From the beginning of the IMS/REMP project, it was noted that the amount of data and information readily available (and usable) for decision-making in the region is relatively limited. This relates to the essential regional baseline as well as to the regular monitoring of changes in ecosystems and environment, essential for decision-making and for assessment of the impacts of the implementation of the proposed SAP strategies.

This lack of data and information, already recognised in the Causal Chain Analysis as a Root Cause, is partly due to the existing reservations concerning the free and open sharing of ecosystem, environment and fisheries data and information in the region. Another cause is the limited capacity at institutional levels in many countries for proper management of data and information, including the management of long term (paper and digital) archives. Yet another complicating factor is the limited comparability and compatibility of data from different sources within the region, from different geographic regions and obtained at different moments in time. Therefore it was considered appropriate for IMS/REMP to investigate for cost-effective additional ways to acquire data and information on the actual status of ecosystems and environment in the region, to be made available through the IMS to the different key organisations in the region, including OSPESCA, WECAFC, CRFM and UNEP-CEP.

As one option, the "Ferrybox" concept was considered. This concept, already successfully applied in other parts of the world, implies the use of ships that routinely cross the seas of the region as platforms for automatic observations. To this end, equipment is installed on

board, autonomously acquiring data, recording this data, and transmitting this data (together with data on location and date/time) to a central office on shore.

A good example is the Mexican NAVIC system (Plenumsoft), which is being used on board small fishing vessels, and was primarily developed in the context of a programme to increase safety at sea. Contacts with NAVIC have been established and are awaiting further development, probably in the form of a demonstration project. Such a project would show how this real time data can be made accessible through the IMS, and also has relevance in the context of Global Ocean Observing System (GOOS).

Of course, suitable ships should be identified that cover the CLME+ region, and they should be found willing to host the Ferrybox equipment on board. To this end, a list was compiled of shipping companies operating in the CLME+ region that potentially could act as partners in a future CLME-Ferrybox programme. This list is available as a separate document as deliverable D.3.7.2.

In this context, the fishing industry itself could also contribute to the understanding, health and management of marine ecosystems and environment by collecting ocean, weather and climate data that contribute to describing the status, trends and variability of ocean, weather and atmosphere conditions and, importantly, which improves the understanding, modelling and forecasting of ocean ecosystems and environment. The experience gained from the recent "Smart Fishing Vessels" initiative in Canada could be of great interest, and when implemented could become a valid component of GOOS.

In addition, information from local communities (traditional information) forms a welcome and often unique complement to scientific information. Although not always strictly in a standardised form, the information often contains details that escape scientific measurements and observations. An organisation active in this field in the region is Coopesolidar from Costa Rica. Such information could be acquired through a regional "crowd sourcing" activity.

The Technical Centre for Agricultural and Rural Cooperation (CTA) is a joint international institution of the African, Caribbean and Pacific (ACP) Group of States and the European Union (EU). CTA's mission is to advance food and nutritional security, increase prosperity and encourage sound natural resource management in ACP countries⁴. It provides access to information and knowledge, facilitates policy dialogue and strengthens the capacity of agricultural and rural development institutions and communities. Recently CTA also became involved with fishing communities in the Caribbean region, strengthening their position in the governance process related to fisheries. Central to achieving its mission are valued partnerships with national governments and regional bodies (including the CLME stakeholders). CTA also works closely with a wide network of ACP-EU public and private sector bodies as well as with international organisations around the world, including UNEP and FAO.

In order to increase the involvement of local communities in the decision making process, CTA promotes a participatory approach through hand-on application of geographic information systems. A training event of this methodology called PPGIS was attended by a representative of IMS/REMP and the corresponding report and course materials are separately available (deliverable D.3.7.3)

⁴ ACP countries relevant for CLME+: Antigua and Barbuda, Bahamas, Barbados,, Belize, Dominica, Grenada, Guayana , Haiti , Jamaica , Republica Dominicana, St Kitts and Nevis, St Lucia, St Vincent and The Grenadines, Surinam, Trinidad and Tobago

Data and information generated through the PPGIS methodology could form a useful complement to other forms of data acquisition within CLME such as ad hoc surveys and monitoring, and would form a valuable contribution to the baseline and the regular monitoring required as a reference for the SAP implementation. Therefore it is recommended to investigate the applicability of the PPGIS methodology for the next phases of CLME.

For the same reason, consideration was given to the possible role of social media in the collection of data and information. A short report on this issue is available separately (deliverable D.3.7.4). Some of the key benefits and challenges associated with the development of a social media strategy for IMS/REMP have been identified as follows:

Benefits

- Disseminates promotional materials including photos, maps, video, working documents, and main website;
- Creates networks with partnerships organizations that are susceptible to become a source of IMS/REMP followers;
- Create networks between individuals that are susceptible to use IMS/REMP;
- Promotes new entries for or applications of the IMS/REMP database (crowd sourcing);
- Cost effective: most social media products are free of charge.

Challenges

- Time consuming: requires constant information input from the site administrator.
- Social media in the region is essentially used as a form or leisure activity and is not principally used to be informed on work-related subjects.

The report concludes that it is not conclusive that an exhaustive social media strategy would best promote IMS/REMP. Nevertheless, millions of potential users can be reached with a Facebook campaign. Given that both UNESCO IOC and the CLME Project already have such a platform, it is recommended that IMS/REMP entries be added to those portals for its initial launch. Perhaps, sporadic news feed could also be added when important announcements or system modification needs to be publicized. This recommendation minimizes the time and cost associated with the development of an IMS/REMP social media strategy and maximizes all potential benefits.

New technological developments, Web 2.0 and mobile computing are changing the ways in which citizens exchange knowledge and information about space and place. A legitimate question is whether current practices are running the risk of being pushed aside at the cost of Volunteered Geographic Information (VGI) and crowd sourcing activities? How can the ethics of the practice serve those innovative technologies? Can we scale-up current practice to wider online communities? These are issues that deserve attention in the following phase of CLME, and IMS/REMP.

Finally, noting the success of YouTube and Ustream, it is recommended to use these systems for capacity building and promotion, especially in relation to harmonization of monitoring and to capacity building on data and information management. An experiment to this effect is under preparation with SOD-Next, Netherlands.

16. ECONOMIC VALUATION OF ECOSYSTEM-BASED GOODS AND SERVICES

The value of ecosystem components is an important issue for governance because it is one of the key arguments used by the decision-makers to justify their investments (or lack of investments) in protection and conservation of the ecosystem. As a reference on this theme, the IMS provides the user with annotated references to publications in English and in Spanish on the issue of economic valuation of ecosystem-based goods and services, based upon contributions received from CERMES and from the Colombian NGO Biomunicipios (part of deliverable D.3.4).

In addition to the provision of references in the IMS to existing literature on the subject, an evaluation was made of the different methods for economic valuation of Ecosystem-based Goods and Services (EG&S) that have been developed and are being used in the world and the region. It appears that many of these are very specific and as a consequence generally do not allow for comparison between different methods. This evaluation is available as a separate report (D.3.7.5) while below the main conclusions are presented.

Economic valuation of EG&S provides essential information on the value people place on marine and coastal resources and processes. This value is an important element in the decision-making process. Consequently, the EG&S economic valuation issue should be included as part of the IMS.

Given that economic valuation methods are embedded in human behaviour trends based on choices, the inclusion of this data could be used as a form of public participation in the governance of transboundary issues in the CLME+ region. Economic valuation also accounts for EG&S that are not included in present markets, and addresses negative externalities. Although based on utilitarian views, which poorly account for non-use values, monetary valuation of EG&S allows decision-makers to compare, dollar for dollar, between management strategies and specific actions. This enhances the legitimacy of conservation and management programs, and eases understanding of the significance of marine issues by stakeholders. At a time where government's budgets are considerably reduced and external financing sources are scarce, any information that allows for enhanced economic efficiency and welfare of communities, should to be assessed, analysed, and included in the policy cycle.

However, the various limitations associated with valuation methodologies are not trivial. This suggests that information obtained using economic valuation should be complementary to a broader range of indicators. In fact, it is argued that the subjectivity, and fundamental limitations embedded in the economic valuation exercise leads to an under-evaluation of EG&S total economic value. Although some bias can be addressed through meticulous development of surveys, the cumulative effect of people's ability to correctly assess EG&S values can be questioned. Also, present EG&S values demonstrate low transferability from one context to the next, and from one scale to another, which is problematic for a regional approach such as the CLME. At best, these economic valuations can be used to express the lowest monetary value of nature's capital.

Continuous research and development in economic valuation techniques, along with a more integrated approach, should be used in the quest to include EG&S in the decision-making process, and thus implement holistic environmental policies.

17. LESSONS LEARNT

On the basis of the experience gained during the IMS/REMP project, the following lessons learnt can be formulated:

- As a sound basis for decision-making, and for the successful implementation of the SAP Strategies, the region needs a mechanism for harmonized monitoring of marine-coastal ecosystems and environment. This monitoring should include inland basins, beaches, mangroves and wetlands, because of their close and vital interactions with and impacts upon the issues and sectors identified by the 3x3(4) matrix. Special attention should be given to monitoring at the local scale where the dynamics of the main problems (contamination, habitat change, overfishing) are high and the resulting impacts upon coastal and reef fisheries and upon the livelihoods of fishing communities are at maximum. This monitoring mechanism should as much as possible be developed on the basis of and by harmonizing existing regional and national monitoring efforts, complemented with additional components where needed.
- It is important and urgent to establish an updated baseline on ecosystems, environment and socio-economy, as a reference to be able to assess the results of measures, actions and interventions, such as proposed by the CLME Strategic Action Programme, SAP. The establishment of such baseline could be implemented as a concerted regional effort, and be combined with intensive capacity building efforts along the full chain, from data acquisition in the field via institutional data and information management to the presentation of indicators and other information products to decision makers.
- The region needs a harmonized monitoring of the fisheries industry and the fishing effort (including white, grey and black market), and a periodical scientific assessment of the available stocks. In that context it would also be recommendable to try and quantify the damage to reefs and benthic ecosystems caused by illegal trawling, which according to some experts is having considerable and long term impact upon the available marine living resources of the region.
- Noting that the national institutions in the region are the primary source of data and information to generate adequate indicators for regional governance, it is recommended to evaluate and strengthen where needed, the data and information mechanisms, from institutional to regional level through the provision of dedicated training, as well as hardware and software. The indicators thus generated form an essential underpinning of a successful implementation of the SAP Strategies, providing information on impacts and trends.
- Regional governance would benefit from the availability of facilities for making forecasts and simulations of the essential ecosystems and environment processes, and their related socio-economic issues, as part of a DSS. To this end it is recommended to develop regional R&D projects aimed at the development of the numerical models required to realize such facilities.
- Regional governance would benefit from the availability of information on previous actions and measures deployed in the context of the SAP implementation, and on their effects, as a basis for a new cycle of the decision making process (policy cycle) and as part of a DSS (adaptive management). Expert/knowledge systems are a recognised tool for this purpose, requiring that the relevant information is translated to the "learning" environment of the system. In this context it is recommended to develop regional R&D projects aimed at the development of dedicated expert/knowledge systems.

- The countries and institutions of the region have repeatedly expressed their reservations with respect to free and open exchange of data and information on ecosystems, environment, socio-economy and fisheries. This vital issue has also been recognised by other projects, including IWCAM. In order to ensure the availability of data and information necessary to generate reliable and updated indicators for governance of the shared marine living resources, it is therefore essential that a regional agreement is reached on a common data policy for CLME as a basis for the sharing of data and information aimed at the successful implementation of the SAP.

18. FUTURE THEMES FOR IMS

Based upon the experience gained during the project and the feedback from the CLME community, and because of their immediate relevance to the shared marine living resources of the region (and consequently their possible impact upon the results of SAP implementation), the following issues have been suggested as new themes for inclusion in the IMS:

- Information on marine-coastal invasive species in the Caribbean, which in a number of cases form an immediate threat to the current species of shared marine living resources, their ecosystems and environment. Suitable providers for this information in the region have been identified.
- Information on the status of beaches in the countries of the region, since they form an essential component of the ecosystems of the region, and are subject to a number of threats. Suitable providers for this information in the region have been identified.
- Ecosystem and environment related information and data products, derived from satellite observations, such as trends of water temperatures, chlorophyll and winds, as well as impacts in the form of turbid water from adjacent LME's. The advantage of these observations is their large geographic coverage combined with moderate to high spatial detail, which helps to understand the relevant processes and changes, including issues such as impacts upon habitats from human intervention and climate. Various suitable providers for this information in the region have been identified.
- Information sources in the context of the Global Ocean Observing System, GOOS, in view of its potential to add updated data and information on ecosystems and environment. A list of the current GOOS sources has been compiled and is available as a separate document (part of deliverable D.3.7.6).

19. SUSTAINABILITY OF THE IMS/REMP

Concerning the sustainability of the IMS/REMP it is planned that in the future the system will become self-sustaining on the basis of the provision of products and services to a number of committed users in government, private industry, and research. The CLME project's next phases will form the context of further development and tuning of the capabilities of the IMS/REMP following a demand-driven approach primarily responding to specific policy questions. This includes supporting and monitoring the implementation and impacts of interventions and actions proposed by the SAP through the provision of dedicated data products and services (indicators).

Although over time other alternatives might come into view, in order to ensure the continuity of the operation of the IMS/REMP, and noting the positive experience over the recent months, it is recommended to leave the technical management with GCFI and the overall management with IOCARIBE; the required funds should be included in the budget of the

next phase of CLME. Meanwhile the distribution of the responsibilities for the maintenance and updating of the information in the IMS over committed providers will help to reduce the burden of budget for IMS/REMP.

20. RECOMMENDATIONS: THE WAY FORWARD

The following specific recommendations concerning IMS/REMP are proposed for inclusion in next phases of the CLME project:

- Develop, in close concert with the stakeholder organisations and other relevant users, a detailed list of key products and services (indicators) required to support the SAP implementation process in the following phases of the CLME project, and ensure their availability through the IMS/REMP.
- Strengthen the network of national contacts in the CLME+ countries related to IMS/REMP in order to ensure the provision of information to the IMS, as well as the management of specific IMS contents, in order to support the generation of the products and services (indicators) required by the SAP process and other policy related issues; this should include the former Dutch Antilles and the French and UK territories. This effort should also include the establishment of a regional network of “national data and information coordination committees”, based upon the national contacts that resulted from the IMS/REMP Promotion and Awareness workshop.
- Evaluate and strengthen where necessary, the institutional capacity in the CLME countries for management of data and information, focusing on the full chain from measurements in the field to the final product for decision makers, as an essential basis for the generation of reliable indicators for decision-making and for the SAP implementation process. In this context, IOC and IODE (including ODINCARSA), based upon the experience with marine data and information management, could play an important role.
- Harmonize the current monitoring efforts of ecosystems and environment in the region, and evaluate the current possibilities to ensure the compatibility and comparability of the resulting data and information across the CLME+ region, required to underpin the generation of reliable indicators for decision-making; in this context consider the establishment of a regional facility for calibration and intercalibration of measurements and observations. Also here, IOC and IODE could provide a valuable contribution.
- Compile a uniform updated baseline on ecosystems, environment and socio-economic issues, necessary as a reference to assess the results of the implementation of the SAP Strategies. The establishment of such baseline could be implemented as a concerted regional effort, and be combined with intensive capacity building efforts along the full chain, from data acquisition in the field via institutional data and information management to the presentation of indicators and other information products to decision makers. This effort should include a closer link with the fishing communities of the CLME+ countries as well as projects dedicated to the salvage of relevant historical data and information archives.
- Agree on a common data policy between the CLME countries on the basis of the draft developed and proposed by IMS/REMP, and taking into account other data policies such as of IOC, WMO and GBIF, in order to improve the sharing of essential data and information on ecosystems, environment and related issues for generation of indicators supporting the SAP process and decision-making.

- Promote regional R&D projects aimed at the integration and development of numerical models and of suitable expert systems as additional tools for forecasts and simulation in the context of DSS.
- Strengthen the contact with CTA, Wageningen, the Netherlands, aimed at benefits for both sides, especially looking at the desired sustainability of the results of CLME, and of IMS/REMP after the project, and the added value of the PPGIS approach for IMS/REMP.
- Carry out a pilot project with the MAVIC VMS equipment (Mexico) in order to demonstrate and evaluate the value of the Ferrybox concept for monitoring the environment of the region; in this same context, establish contacts with the relevant shipping lines in the region, about the possible location of Ferrybox equipment onboard their ships, and link the results with GOOS and IMS/REMP.
- Add new themes to the IMS: Invasive Species; State of Beaches; satellite-derived data and information on ecosystems and environment; GOOS data sources; NODC's in the region, Environmental and Ecosystem Monitoring (technologies and methodologies), Integrated Coastal Zone Management (outcome of pilot project), Funding Opportunities, Ongoing Projects in the region.
- Improve the graphic and GIS capabilities of IMS, add functionality to accept bulk updates, and add functionality for transparent searches in other on-line systems such as CMA (deliverable D.3.7.7.) and OBIS.
- Leave the management of the IMS system with GCFI, and identify an IMS interim manager, who also will be responsible for the REMP component; in view of IOCARIBE's competence and history in the field of data and information management, it is recommended to locate this manager at the IOCARIBE secretariat. In this way, the continuity of IMS/REMP can be guaranteed for the next phases of the CLME project and beyond.

21. LIST OF ACRONYMS AND ABBREVIATIONS

BCZMU	Barbados Coastal Zone Management Unit
CARICOM	Caribbean Community and Common Market
CBD	Convention on Biological Diversity
CBO	Community-Based Organisation
CCA	Causal Chain Analysis (CLME Project)
CCAD	Central American Commission for Environment and Development
CDT CLME	SAP Core Development Team
CEHI	Caribbean Environmental Health Institute
CEP	Caribbean Environment Programme (UNEP)
CERMES	Centre for Resource Management and Environmental Studies
CFMC	Caribbean Fisheries Management Council
CITES	Convention on the International Trade of Endangered Species
CLME	Caribbean Large Marine Ecosystem
CLME+	Caribbean and North Brazil Shelf Large Marine Ecosystems (CLME Project)
CMA	Caribbean Marine Atlas
CRFM	Caribbean Regional Fisheries Mechanism
CSC	Caribbean Sea Commission
CSME	Caribbean Single Market Economy
CTA	Technical Centre for Agricultural and Rural Cooperation
DIMAR	Maritime Directorate (Colombia)
DSS	Decision Support system
EAF	Ecosystem Approach to Fisheries
EBM	Ecosystem-based Management
EcoQO	Ecosystem Quality Objective (CLME SAP)
EG&S	Ecosystem-based Goods and Services
ESI	Environmental Status Indicator
FAO	Food and Agricultural Organization of the United Nations
FEST CLME	SAP Formulation and Endorsement Support Team
GBIF	Global Biodiversity Information Facility
GDP	Gross Domestic Product
GEF	Global Environment Facility
GRAMED	Global and Regional Assessments of the Marine Environment Database
ICES	International Council for the Exploration of the Seas
IGO	Inter-Governmental Organization
IMO	International Maritime Organization
IMS	Information Management System (CLME Project)
INVEMAR	Marine and Coastal Research Institute (Colombia)
IOC	Intergovernmental Oceanographic Commission of UNESCO
IOCARIBE IOC	UNESCO Sub-commission for the Caribbean Sea and Adjacent Regions
IODE	International Oceanographic Data Exchange (IOC)
IUU	Illegal, Unreported and Unregulated fishing
IW	International Waters (GEF)
LBS	Land Based Sources of Pollution
LME	Large Marine Ecosystem
LMR	Living Marine Resources (CLME Project)
MARPOL	International Convention for the Prevention of Pollution from Ships
M&E	Monitoring and Evaluation
MCS	Monitoring, Control and Surveillance
MPA	Marine Protected Area
NBSLME	North Brazil Shelf Large Marine Ecosystem
NFPs CLME	National Focal Points
NGO	Non-Governmental Organization
NIC	National Inter-sectoral Committee (CLME Project)
ODINCARSA	IODE project for Latin America and the Caribbean (IOC)
OECS	Organization of Eastern Caribbean States
OSPESCA	Central America Fisheries and Aquaculture Organization

PCU	Project Coordination Unit (CLME Project)
REMP	Regional Environmental Monitoring Programme (CLME Project)
RFMO	Regional Fisheries Management Organisation
RGF	Regional Governance Framework (CLME Project)
SAP	Strategic Action Programme (CLME Project)
SBO	Societal Benefits Objective (CLME SAP)
SD	Strategic Direction (CLME SAP)
SGP	Small Grants Programme (GEF)
SICA	Central American Integration System
SIDS	Small Island Developing States
sLMR	shared Living Marine Resources (CLME Project)
SPAW	Specially Protected Areas and Wildlife Protocol (Cartagena Convention)
TDA	Transboundary Diagnostic Analysis (CLME Project)
TNC	The Nature Conservancy
TWAP GEF	Transboundary Waters Assessment Programme
UNAM	National University of Mexico
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USF	University of South Florida
VGI	Volunteered Geographic Information
WECAFC	Western Central Atlantic Fisheries Commission
WSSD	World Summit on Sustainable Development.