

# Integrated Management of the Benguela Current Region

## A Framework for Future Development

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### ABSTRACT

Recent initiatives have been developed jointly by Angola, Namibia, and South Africa, three countries bordering on the Benguela Current Large Marine Ecosystem (BCLME), to address the legacy of fragmented management — a consequence of the colonial and political past — and to ensure the integrated sustainable management of the marine and coastal regions in the Southeast Atlantic. Examples of some of these activities and the processes followed are provided. Science and technology are recognized as fundamental building blocks underpinning the management process and, at all levels, the development of capacity — both human and material — is an overarching objective. Some recent successes of a regional fisheries-environment science and technology program BENEFIT are highlighted and serve to demonstrate the commitment of the three governments to collaboration in this area. At a country level, brief details are provided about coastal policy development by way of showing how South Africa proposes to correct some of the wrongs of the past and sustainably utilize one of its most valuable resources, i.e., the coast itself. At the regional ecosystem management level, information is given about an embryonic initiative, the BCLME Programme, which will provide a sound basis for the integration of science, technology, socioeconomics, and management to ensure a sustainable future for the Benguela Current as an ecosystem and the utilization of its coastal and marine resources. Transboundary issues feature high on the agenda.

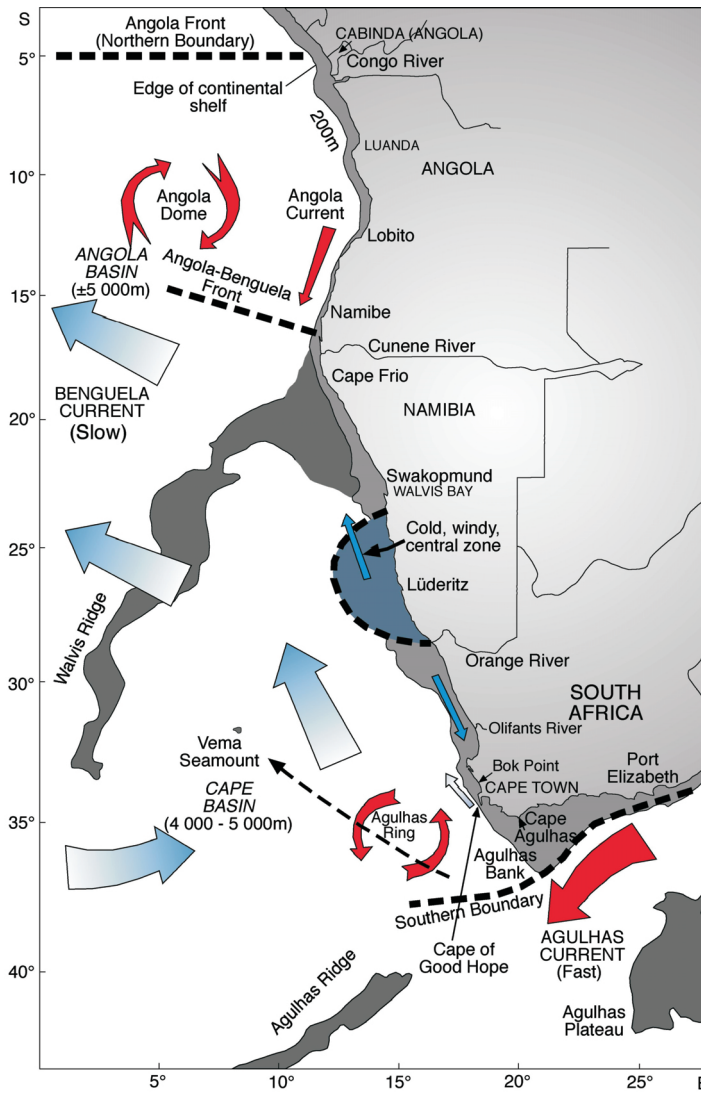
It is the view of the authors that the actions taken jointly by Angola, Namibia, and South Africa can serve not only as a blueprint for the application of science and technology in the southern African context, but also for the integrated sustainable management of marine and coastal systems which are shared by two or more countries elsewhere in the developing world.

## BACKGROUND AND INTRODUCTION

### The Benguela: A Unique Environment

The Benguela Current region is situated along the coast of southwestern Africa, stretching from east of the Cape of Good Hope in the south northwards to Cabinda in Angola and encompassing the full extent of Namibia's marine environment (see Figure 15.1). It is one of the four major coastal upwelling ecosystems of the world which lie at the eastern boundaries of the oceans. Its distinctive bathymetry, hydrography, chemistry, and trophodynamics combine to make it one of the most productive ocean areas in the world, with a mean annual primary productivity of  $1.256 \text{ g C m}^{-2} \text{ y}^{-1}$  (Brown et al. 1991)—about six times higher than the North Sea ecosystem. This high level of primary productivity of the Benguela supports an important global reservoir of biodiversity and biomass of zooplankton, fish, seabirds, and marine mammals, while near-shore and off-shore sediments hold rich deposits of precious minerals (particularly diamonds), as well as oil and gas reserves. The natural beauty of the coastal regions, many of which are still pristine by global standards, have also enabled the development of significant local tourism initiatives. Pollution from industries, poorly planned and managed coastal developments as well as near-shore activities are, however, causing a rapid degradation of vulnerable coastal habitats in some areas.

The Namib Desert, which forms the landward boundary of the greater part of the Benguela Current system, is one of the oldest deserts in the world, predating the commencement of persistent upwelling in the Benguela (12 million years before present) by at least 40 million years. The upwelling system in the form in which we know it today is about 2 million years old. The principal upwelling center in the Benguela, which is situated near Lüderitz in southern Namibia, is the most concentrated and intense found in any upwelling regime. What also makes the Benguela upwelling and adjacent coast system so unique in the global context is that it is bounded at both northern and southern ends by warm-water systems, i.e., the tropical/equatorial Western Atlantic and the Indian Ocean's Agulhas Current, respectively (Shannon and Nelson 1996). Sharp horizontal gradients (fronts) exist at these boundaries of the upwelling system, but these display substantial variability in time and in space — at times pulsating in phase and at others not. Interaction with the adjacent ocean systems occurs over thousands of kilometers. For example, much of the Benguela marine environment, in particular off Namibia and Angola, is naturally hypoxic—even anoxic—at depth as a consequence of subsurface flow southwards from the tropical Atlantic (cf. Bubnov 1972; Chapman and Shannon 1985; Hamukuaya et al. 1998). This is compounded by depletion of oxygen from more localized biological decay processes. There are also teleconnections between the Benguela and processes in the North Atlantic and Indo-Pacific Oceans (e.g., El Niño). Moreover, the southern Benguela lies at a major choke point in the “Global Climate Conveyor Belt,” whereby on longer time scales, warm surface waters move from the Pacific via the



**Figure 15.1** External and internal boundaries of the Benguela Current Large Marine Ecosystem, bathymetric features, and surface (upper layer) currents.

Indian Ocean through into the North Atlantic. (The South Atlantic is the only ocean in which there is a net transport of heat towards the equator!).

As a result, not only is the Benguela at a critical location in terms of the global climate system, but its marine and coastal environments are also potentially extremely vulnerable to any future climate change or increasing variability in climate — with obvious consequences for long-term sustainable management of the coast and marine resources.

### **Fragmented Coastal and Marine Resource Management: A Legacy of the Colonial and Political Past**

Following the establishment of European settlements at strategic coastal locations where victuals and water could be procured to supply fleets trading with the East Indies, the potential wealth of the African continent became apparent. This subsequently resulted in the great rush for territories and the colonization of the continent — mostly during the nineteenth century. Boundaries between colonies were hastily established, often arbitrary and generally with little regard for indigenous inhabitants and natural habitats. Colonial land boundaries in the Benguela region were established at rivers (e.g., Cunene, Orange). The languages and cultures of the foreign occupiers were different (Portuguese, German, English, Dutch) and so were the management systems and laws which evolved in the three now independent and democratic countries of the region — Angola, Namibia, and South Africa. Moreover, not only were the governance frameworks very different, but a further consequence of European influence was the relative absence of interagency (or interministerial) frameworks for management of the marine environment and its resources and scant regard for sustainability. To this day, mining concessions, oil/gas exploration, fishing rights, and coastal development have taken place with little or no proper integration or regard for other users. For example, exploratory wells have been sunk in established fishing grounds and the wellheads (which stand proud of the sea bed) subsequently abandoned. Likewise, the impact of habitat alterations due to mining activities and ecosystem alteration (including biodiversity impacts) due to fishing have not been properly assessed.

Prior to the United Nations Convention on the Law of the Sea in 1982 (United Nations 1983) and declaration and respecting of sovereign rights within individual countries' exclusive economic (or fishing) zones (EEZs), there was an explosion of foreign fleets fishing off Angola, Namibia, and South Africa during the 1960s and 1970s — an effective imperialism and colonization by mainly First World countries of the Benguela Current Large Marine Ecosystem (BCLME) and the rape of its resources. This period also coincided with liberation struggles in all three countries and associated civil wars. In the case of Namibia, over whom the mandate by South Africa was not internationally recognized, there was an added problem in that prior to independence in 1990, an EEZ could not be proclaimed. In an attempt to control the foreign exploitation of Namibia's fish resources, the International Commission for the South-east Atlantic Fisheries (ICSEAF) was established, but this proved to be relatively ineffectual at husbanding the fish stocks. In South Africa prior to 1994, there was generally a scant regard for environmental issues or sustainable environmental management. Moreover, colonialism, civil wars, and the apartheid legacy have resulted in a marked gradient in capacity from south to north in the region. Another consequence of the civil wars has been the population migration to the coast and localized pressure on marine and coastal resources (e.g., destruction of coastal forests and mangroves), severe pollution of some embayments, and *de facto* impossibility of any form of integrated coastal zone management along large stretches of the Benguela coast.

While mineral exploration and extraction and developments in the coastal zones obviously occur within the geographic boundaries of the three countries, i.e., within the EEZs, and can to a large degree be independently managed by each of the countries, mobile living marine resources do not respect the arbitrary geographic borders. This has obvious implications

for the sustainable use of these resources, particularly so in the case of straddling and shared fish stocks.

Thus the legacy of the colonial and political past is that the management of resources in the greater Benguela area has not been integrated within countries or within the region. The real challenge will be to develop a viable joint and integrative mechanism for the sustainable management of the coast and marine resources of the Benguela as a whole.

### **Regional Self-help: Joint Action by Three Developing Countries for a Sustainable Future**

This historical scenario poses almost insurmountable problems for the countries bordering on the Benguela. Notwithstanding this, Angola, Namibia, and South Africa have, over the past three years, made substantial progress to address the science and management issues in a pragmatic, cost-effective manner. In this chapter we provide details about some of the joint (regional) and individual country actions which have been taken to overcome the difficulties, highlight some recent successes, and outline plans which the three countries collectively have to ensure that the greater Benguela Current region is sustainably used and managed through the proper application of science and technology. This approach could well serve as a blueprint in other parts of the world for the integrated management of marine and coastal systems which are shared between two or more developing countries.

At the *regional* level the approach has been somewhat different, however, from that which would normally be taken in developed countries and coastal areas with “concave coastlines” for the following reasons: First, much of the coast in the Benguela region is relatively pristine and/or inaccessible — except for small pockets of urban development. Second, many of the “coastal” issues concern the marine rather than the terrestrial system. Third, the transboundary problems which are amenable to management action are those relating to marine systems, e.g., shared fish resources. (It is just not feasible to attempt to address transboundary issues associated with, for example, the Congo River and its drainage basin). Fourth, (natural) environmental variability and change are major factors influencing natural resources and the way in which these are managed in an open “convex” system, such as the Benguela. While this cannot be controlled, cost-effective environmental monitoring and appropriate science for better predictability can improve marine and coastal resource utilization and management. Finally, but perhaps most important, is the need throughout the region to develop human and infrastructure capacity and to share available knowledge and skills. What better way to proceed than through the application of the appropriate science and technology! This is in keeping with the philosophy so well articulated by Sherman (1994).

### **A REGIONAL MARINE SCIENCE SUCCESS STORY — “BENEFIT”**

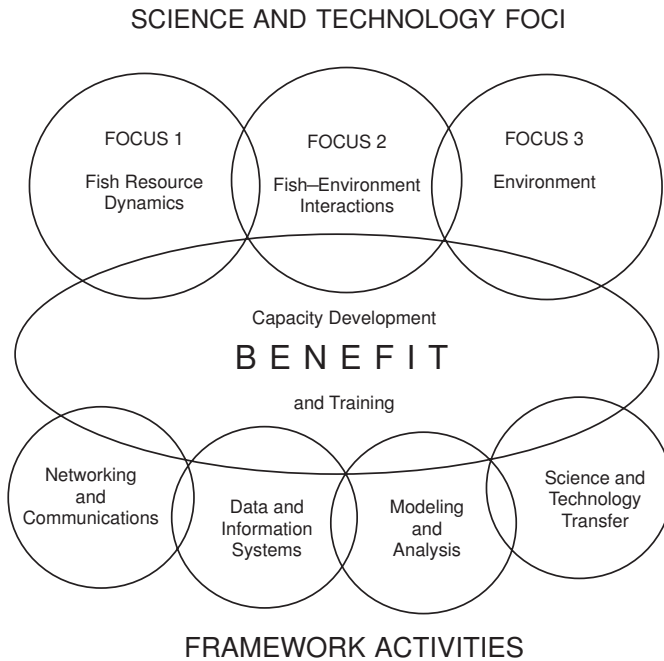
In April, 1997, a major regional cooperative initiative was launched jointly by Angola, Namibia, and South Africa together with foreign partners “to develop the enhanced science capacity required for the optimal and sustainable utilization of living resources of the Benguela ecosystem by (a) improving knowledge and understanding of the dynamics of important commercial stocks, their environment and linkages between the environmental

processes and the stock dynamics, and (b) building appropriate human and material capacity for marine science and technology in the countries bordering the Benguela ecosystem" (BENEFIT 1997). The Benguela–Environment–Fisheries–Interaction–Training Programme (BENEFIT) evolved out of a workshop/seminar on "Fisheries Resource Dynamics in the Benguela Current Ecosystem" held in Swakopmund in mid-1995 and hosted by the Namibian Ministry of Fisheries and Marine Resources in partnership with the Norwegian Agency for Development Cooperation (NORAD), the German Organization for Technical Cooperation (GTZ), and the Intergovernmental Oceanographic Commission (IOC) of UNESCO. BENEFIT has attracted substantial incremental support from overseas countries and international donor agencies. It remains, however, essentially a regional "self-help" initiative and has been endorsed by the Southern African Development Community (SADC) and accepted as a SADC program. It is providing a unique opportunity for development of partnerships within and beyond the southern African region in science and technology to promote optimum utilization of natural resources and thereby greater food security in the region.

BENEFIT has been planned in two five-year phases (1997–2002, 2002–2007). The science and technology component of BENEFIT has three foci: resource dynamics, the environment (of the resources), and linkages between resources and the environment. These foci are increasing knowledge of resource dynamics through improved research on the resources and their variable environment. The capacity development component of the program is being addressed through a suite of task-oriented framework activities to (a) build human capacity, particularly in areas of greatest need and greatest historical disadvantage, (b) develop, enhance, and maintain regional infrastructure and cooperation, and (c) to make the countries in the region and the region as a whole more self-sufficient in science and technology. The linkages between the three science foci and the suite of framework activities are illustrated schematically in Figure 15.2. BENEFIT has a Secretariat based in Namibia, while management meetings are held on a rotating basis in Angola, Namibia, and South Africa.

The launch of BENEFIT in April 1997 coincided with two major research cruises/surveys of the Angola–Benguela Front focusing on fisheries and environmental issues. (This front is situated west of Angola and is thought to play an important role as a permeable "boundary" between the tropical Atlantic and the upwelling region of the Benguela). During the past two years, BENEFIT has increasingly gathered momentum: funding for priority projects has been allocated and real progress in human capacity development has been made. Some recent achievements are briefly:

- Several reports and scientific/technical papers have been published on the results of the 1997 Angola–Benguela Front surveys, and several regional scientists and technicians received hands-on training at sea, in the laboratory, and in data analysis.
- A German-sponsored BENEFIT training course was conducted in Namibia in 1997, and a number of regional scientists received further training subsequently in Germany and in Norway.
- Fifteen fisheries and fisheries-environment projects were approved for funding in 1999.
- Two training workshops have taken place (1998 and 1999) and a BENEFIT Training Plan to complement the Science Plan is under development.



**Figure 15.2** Schematic of the BENEFIT structure showing the interlinking science and technology foci and framework activities.

- In the first half of 1999, over 50 persons from the broad SADC region (i.e., including East African nations) have been trained during three BENEFIT cruises, including a 40-day survey of resources and the environment which extended between Cape Town and Luanda, primarily funded by the African Development Bank and the World Bank.

BENEFIT and related activities provide clear evidence of the desire and capability of Angola, Namibia, and South Africa to work together to solve common marine/fisheries science problems in the Benguela region in partnership with the international community.

### **A COUNTRY-BASED APPROACH TO ICM: SOUTH AFRICA AS AN EXAMPLE**

#### **The Need**

In comparison with many other countries, South Africa’s coastal areas have a low overall population density and large areas that are relatively underdeveloped, particularly in terms of opportunities for the poorer sections of the community. This is a result of a number of factors, including migrant labor, apartheid planning policies, and historical population movements. The coastal population is now growing as a result of recent political and economic changes in South Africa. These changes include the removal of barriers to movement, a decline in inland



extractive industries, and increasing opportunities associated with coastal resources, such as tourism and port development. Future economic growth in South Africa is likely to concentrate along the coast and the pace of development in coastal areas is already accelerating. For example, five out of the eight Spatial Development Initiatives are linked to the coast and the direct contribution of coastal areas and resources to the gross domestic product of South Africa is estimated as 37%. This presents a unique management challenge for government, industry, and civil society.

### Coastal Management Policy Programme in South Africa

The Department of Environmental Affairs and Tourism initiated the Coastal Management Policy Programme (CMPP) to promote integrated management of the coast as a system, in order to harness its resources for sustainable coastal development. An extensive process of public participation, supported by specialist studies, began in May, 1997, guided by a policy committee representing the interests of national and provincial government, business, and civil society. A Coastal Policy Green Paper was published in September, 1998, followed by a Draft White Paper for Sustainable Coastal Development in March, 1999 (Draft White Paper 1999).

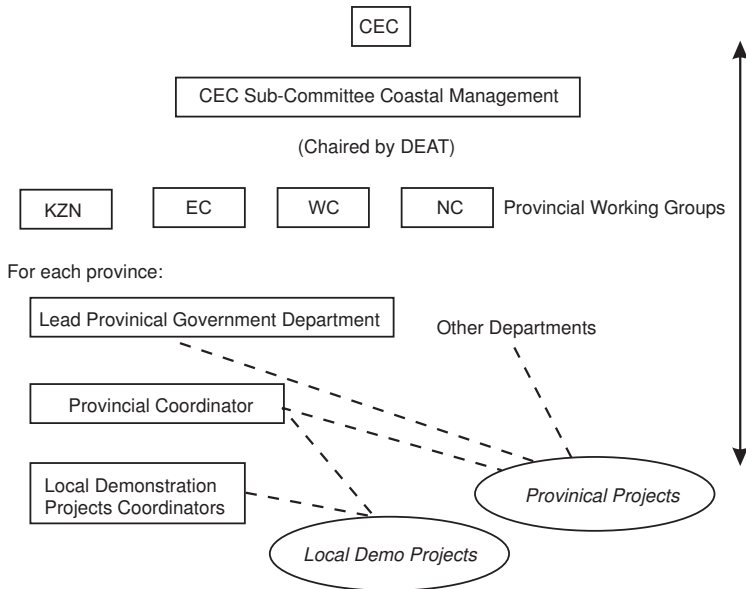
The Draft White Paper advocates the following shifts in emphasis:

- In the past, the value of coastal ecosystems as a cornerstone for development was not sufficiently acknowledged in decision making in South Africa. The policy outlines the importance of *recognizing the value of the coast*.
- In the past, coastal management was resource-centered rather than people-centered and attempted to control the use of coastal resources. The policy stresses the powerful contribution that can be made to reconstruction and development in South Africa through *facilitating sustainable coastal development*. Maintaining diverse, healthy, and productive coastal ecosystems will be central to achieving this ideal.
- In the past, South African coastal management efforts were fragmented and uncoordinated, and were undertaken largely on a sectoral basis. The policy supports a holistic approach by *promoting coordinated and integrated coastal management*, which understands the coast as a system.
- In the past, a “top-down” control and regulation approach was imposed on coastal management efforts. The policy proposes *introducing a new facilitatory style of management*, which involves cooperation and shared responsibility with a range of stakeholders.

However, the institutional capacity to support the integrated approach required to manage coastal development is currently weak, and there is little awareness of the issues among key stakeholders. This both limits the opportunities associated with the coast and threatens the sustainability of development. An action plan to address these issues is presented in the Draft White Paper and centers on four key themes:

1. Developing and supporting an appropriate (integrated) institutional and legal framework across government.
2. Awareness, education, and training programs for government, the private sector, and civil society.





**Figure 15.3** Proposed institutional structure for implementation of the Draft White Paper (1999) for sustainable coastal development in South Africa. CEC: Committee for Environmental Coordination (national body); DEAT: Dept. of Environmental Affairs and Tourism; KZN: Kwa-Zulu Natal; EC: Eastern Cape; WC: Western Cape; and NC: Northern Cape.

3. Information provision in the form of decision support for provincial and local government, monitoring programs, and applied research.
4. Local projects to demonstrate the benefits of effective coastal management and to address national and provincial priority issues.

A cyclical process of review and revision underpins the coastal policy. This allows successive implementation generations to reflect evolving priorities, visions, and institutional capacity. Figure 15.3 represents the institutional structures through which the coastal policy will be implemented.

**Context of the Coastal Policy Within the Benguela Current Region of South Africa**

The Draft White Paper provides a brief overview of South Africa’s coast to sketch the context of the policy in relation to the thirteen coastal regions defined for the purposes of the policy formulation process. The two sections applicable to the Benguela Current region study are the Namaqualand and West Coast coastal divisions. These are bounded by the Orange and Olifants Rivers, and the Olifants River and Bok Point, respectively. The following extracts are lifted from the Draft White Paper.

*Namaqualand*

The Northern Cape province is comprised of only a single coastal region, the Namaqualand coastal region. Some 390 km long, the Namaqualand region is a sparsely inhabited area,

much of which is semi-desert and is largely undeveloped. A lack of physical access to coastal resources and isolation from the center of provincial administration contribute to high poverty levels in the coastal communities.

Although dominated by large mining and fishing companies, the Namaqualand region has the second lowest economic growth rate in South Africa and unemployment has more than doubled since 1980. Challenges include declining fish stocks, poor road infrastructure, lack of sheltered bays for ports, and limited agricultural potential. The closure of many land-based diamond mining operations provides an opportunity for extensive rehabilitation programs to be carried out — to rehabilitate the natural environment and to create alternative livelihoods for people.

Potential exists for the harvesting of underutilized coastal resources, such as mussels and limpets, for small-scale industries that add value to fishing and agriculture, and for small-scale mining. Other natural assets, such as the annual wildflower display, a high diversity of succulent plant species, and the stark beauty of the area offer potential for nature-based tourism with community participation. More equitable distribution of mining and fishing concessions and the development of value-added activities could contribute to retaining revenue in local communities.

### *West Coast*

The West Coast region has displayed significant growth and a relatively strong economy, although rural areas remain poor. Impetus for growth has come from the deep-water port of Saldanha and the proximity of the region to the Cape Metropolitan area. Despite the limited supply of freshwater, substantial investment has been attracted to the region for mariculture, shipping, industrial, manufacturing, tourism, and recreational activities. Much of the area is arid, which limits agricultural potential. The region is, however, well known for its strandveld and fynbos vegetation, which attracts many visitors to the region each spring. The region is at the center of South Africa's fishing industry, with rich fishing grounds supporting capital-intensive industries.

Economic development through industrialization, property development, and tourism has brought challenges for the management of the coast, including air and water pollution, salination of the coastal aquifer, restricted access to coastal resources, ribbon development, and inappropriate land use. Economic development is also attracting many job seekers to the region, increasing the need for infrastructure and government services. Potential exists in the region for the development of small-scale industries that add value to fishing, floriculture, and mariculture, and for tourism promotion initiatives, including the development of rail and air links.

### **Implementing the Coastal Policy in South Africa**

Concurrent with the process of formal ratification of the Draft White Paper, the Department of Environmental Affairs and Tourism has translated the "Plan of Action" into a preliminary five-year implementation proposal. This is being used to seek implementation finance to ensure a reduced lead-in time between policy adoption and policy implementation. Once project funds are secured, detailed design will follow, involving provincial government,

appropriate stakeholders, and specialist individuals and organizations. This process was completed in 2000, and it is hoped that the coastal policy will become government policy. Meanwhile, to maintain momentum of the CMPP, an interim phase program is underway to bridge the gap between the policy formulation and implementation phases. Activities include: specialist advice on an appropriate legislative framework, preparing for the appointment of National and Provincial Coordinators, initiating a needs assessment for public awareness and education programs, preparing and distributing a newsletter to coastal stakeholders, and developing a coastal management web site to better disseminate information.

### **AN INTEGRATED REGIONAL APPROACH TO THE SUSTAINABLE MANAGEMENT OF THE BENGUELA CURRENT AS A LARGE MARINE ECOSYSTEM: THE BCLME PROGRAMME**

In a large marine ecosystem (LME), such as the Benguela Current System, sustainable management at the *ecosystem level* under conditions of environmental variability and uncertainty is a regional issue. The mobile components of the BCLME do not respect arbitrary geopolitical (country) boundaries. Several fish stocks straddle or are shared between the countries or otherwise migrate through the Benguela. Actions by one country, e.g., overexploitation or habitat destruction of their part of a migrating or shared resource, could in effect negatively impact on one or both neighboring countries. Joint management and protection of shared stocks is one of the few available options to the countries bordering the Benguela Current. In this manner, a better sense of ownership of the regions' resources can be attained, as "owners" tend to protect their property more than those enjoying a free service. There is thus a strong need for harmonizing legal and policy objectives and for developing common strategies for resource surveys, and investment in sustainable ecosystem management for the benefit of all the people in the Benguela region. Only concerted regional action with the enablement from the international community to develop regional agreements and legal frameworks and assessment/implementation strategies will in the longer term protect the living marine resources, biological diversity, and environment of the greater Benguela. While shared living resources present the most obvious case for comanagement, there are many examples of nonshared "resources" that can benefit from sharing of expertise and management structures developed and implemented in individual countries. These include *inter alia* mining, declining coastal water quality (pollution abatement and control, oil spill clean-up technology), oil/gas extraction, coastal zone development, tourism and eco-tourism development, mitigation of the effects of introduced species (exotics), and harmful algal blooms, which can also have system-wide impacts.

Whereas the governments of Angola, Namibia, and South Africa have made excellent progress in partnership with members of the international community in addressing the science and technology needs for *fisheries* in the region through the BENEFIT Programme, a viable regional *framework for management* for shared fish resources and *the ecosystem as a whole*, including the coastal zone, is lacking. Building on BENEFIT and on the success of LME initiatives elsewhere in the world (e.g., Black Sea; see Black Sea 1996), whereby incremental funding is made available by the Global Environmental Facility (GEF) of the World

Bank for the development of management structures that address transboundary problems (and which structures become self-funding after 3–5 years), Angola, Namibia, and South Africa with GEF assistance are in the process of developing a LME management initiative for the Benguela Current: the BCLME Programme. This program is a broad-based multisectoral initiative aimed at *sustainable integrated management* of the Benguela Current ecosystem as a whole. It focuses on a number of key sectors, including fisheries, impact of environmental variability, sea-bed mining, oil and gas exploration and production, coastal zone management, ecosystem health, and socioeconomics and governance. Transboundary management issues, environmental protection, and capacity building will be of primary concern to the program. It builds on existing regional capacity and goodwill, and could serve as a blueprint for the design and implementation of LME initiatives in other upwelling regions and elsewhere in the developing world. Moreover, the BCLME Programme will address key regional environmental variability issues that are expected to make a major contribution towards understanding global fluctuations in the marine environment, including climate change.

The BCLME Programme provides an ideal opportunity for the international community to assist the three countries in the region to develop appropriate mechanisms that will ensure the long-term sustainability of the ecosystem. In 1998 a small grant was made by the GEF via the United Nations Development Programme (UNDP) to facilitate the development of a comprehensive proposal. The process involved, which is lengthy and complex, follows prescribed procedures. In essence it is a participatory process involving all key stakeholders in the private and public sectors of the participating countries. Two regional workshops involving over 100 regional and international experts were held (Croll 1998; Croll and Njuguna 1999), consensus was built, a set of six comprehensive thematic reports or integrated overviews were commissioned (fisheries, environment, mining, coast, oil and gas, socioeconomics), an exhaustive Transboundary Diagnostic Analysis (TDA) was undertaken, a Strategic Action Programme (SAP) is being developed, and, finally, a Project Brief formulated. At first appearance the process appears overly bureaucratic and unwieldy, but having gone through the various stages it is clear that the process is rigorous, necessary, and logical. For example, the integrated overviews provided essential input into the subsequent TDA whereby the essential elements were formulated and prioritized through (consensus) group work as per the path issues → problems → causes → impacts → uncertainties → socioeconomic consequences → transboundary consequences → activities/solutions → priority → outputs → costs.

Key aspects of the TDA and SAP follow the next section, which considers BCLME external boundaries.

### **Geographic Scope and Ecosystem Boundaries**

Conducting a comprehensive TDA is only possible if the entire LME, including all inputs to the system, is covered in the study. In the case of the Benguela, which is a very open system where the environmental variability is predominantly remotely forced, this should then include the tropical Atlantic *sensu latu*, the Agulhas Current (and its link with the Indo-Pacific), the Southern Ocean, and the drainage basins of all major rivers which discharge into the greater Benguela Current region, including the Congo River. Clearly, such an approach is

impracticable, and more realistic and pragmatic system boundaries must be defined to develop and implement a viable ecosystem management framework. The principal external and internal system boundaries are shown in Figure 15.1.

#### *Landward Boundary*

With the exception of the Congo River, the main impact of discharges from rivers flowing into the South East Atlantic tends to be episodic in nature, i.e., in terms of significant transboundary concerns, these are limited to extreme flood events. (Their drainage basins nevertheless do include a major part of the southern African hinterland.) The Congo River, however, exerts an influence that can be detected over thousands of kilometers of the South Atlantic and drains much of Central Africa. From a practical point of view, it is quite beyond the scope of the BCLME to attempt to include the development of any management structures for a river such as the Congo. With respect to land sources of pollution in the BCLME (excluding the Congo River area), these are only really significant in the proximity of the principal port cities (e.g., Cape Town, Luanda, Walvis Bay), and the effects are generally very localized. Nevertheless, some of the problems experienced in these areas are common in nature and could be addressed through similar remedial actions. Like coastal development, their impacts generally do not have a transboundary character. (By contrast, pollution from ships, major oil spills, introduction of exotic species, and associated harmful algal blooms, for example, are transboundary concerns). From a BCLME perspective, the landward boundary can thus, for all practical purposes, be taken as the coast. Specific allowances can be made in some areas on a case-by-case basis (e.g., during episodic flooding from the Orange and Cunene Rivers, which are situated at the country boundaries of South Africa–Namibia and Namibia–Angola, respectively).

#### *Western Boundary*

The Benguela Current is generally defined as the integrated equatorward flow in the upper layers of the ocean in the South East Atlantic between the coast and the 0° meridian. The BCLME Programme will accordingly use 0° as the western boundary. For practical management purposes, however, the focus will be on the areas over which the three countries have some jurisdiction, i.e., their EEZs which extend 200 nautical miles seawards from the land.

#### *Southern/Eastern Boundary*

The upwelling area of the BCLME extends around the Cape of Good Hope, seasonally as far east as Port Elizabeth. This extreme southern part of the ecosystem is substantially influenced by the Agulhas Current, its Retroflexion (turning back) and leakage of Indian Ocean water into the Atlantic south of the continent. As the variability of the BCLME is very much a function of the complex ocean processes occurring in the Agulhas Current–Retroflexion area, this will be taken as the southern boundary with 27°E longitude (near Port Elizabeth), being at the extreme eastern end.

*Northern Boundary*

While the Angola–Benguela Front (Shannon et al. 1987) comprises the northern extent of the main coastal upwelling zone, upwelling can occur seasonally along the entire coast of Angola. There are, in any event, strong linkages between the behavior of the Angola–Benguela Front (and the oceanography of the area to the south of it) and processes occurring off Angola, especially the Angola Dome and the Angola Current. Unless these are considered as an integral part of the BCLME, it will not be feasible to evolve a sustainable integrated management approach for the Benguela. Moreover, there is a well-defined front at about 5°S, viz. the Angola Front (Yamagata and Iizuka 1995), which is apparent at subsurface depths. This front is the true boundary between the Benguela part of the South Atlantic and the tropical/equatorial Gulf of Guinea system. A northern boundary at 5°S would thus encompass the Angola Dome, the seasonal coastal Angola Current, and the area in which the main oxygen minimum forms, and the full extent of the upwelling system in the South East Atlantic. A pragmatic northern boundary is thus at 5°S latitude, which is close to the northern geopolitical boundary of Angola (Cabinda).

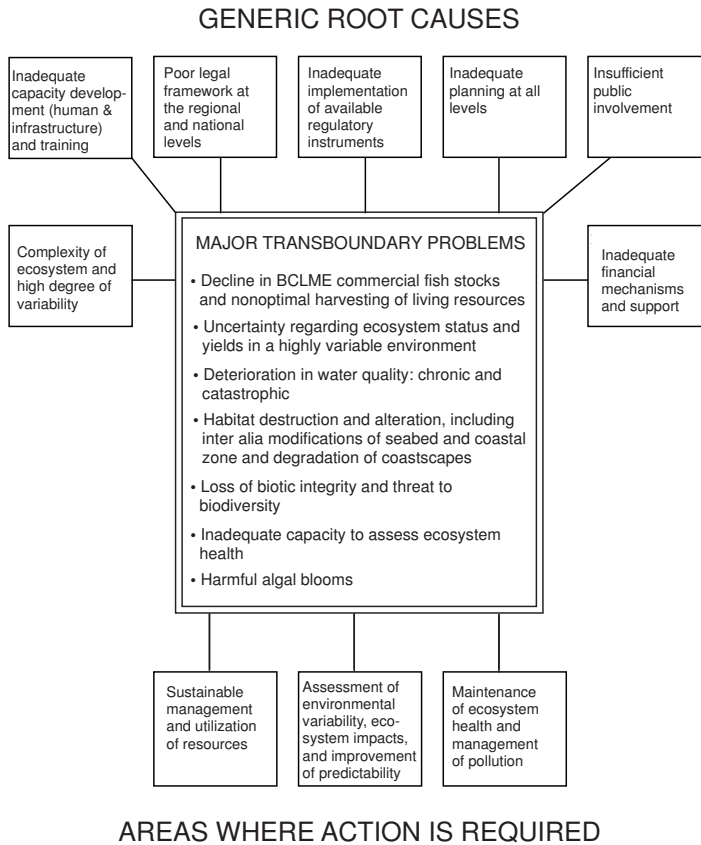
**Issues and Perceived Main Transboundary Problems, Root Causes, and Areas Where Action Is Proposed: The TDA**

Through the participatory TDA process involving regional stakeholders and international LME experts, seven major transboundary problems were identified, their root causes established, and suites of action formulated (BCLME TDA 1999). These are summarized conceptually in Figure 15.4 and expanded in the accompanying synthesis matrix (see Table 15.1). The latter is a “logistical map” which encapsulates the essence of the TDA.

Regional action is clearly required in three main areas: (a) sustainable management and utilization of resources, (b) assessment of environmental variability, ecosystem impacts and improvement of predictability, and (c) maintenance of ecosystem health and management of pollution. Within each of these areas is a suite of subactions. Each of these is examined more fully in the next level of the TDA to determine causes (of the relevant subproblem), likely impacts, risks and uncertainties, socioeconomic consequences, transboundary consequences, proposed activities/solutions, their priority and incremental costing (i.e., cost over and above costs presently spent by national governments), and anticipated outputs. By way of illustration we have extracted one of the several subtables from the BCLME TDA document (Table 15.2). This table is in reality only a summary of the comprehensive information and assessment which comprised the TDA process. It does, however, illustrate how transboundary concerns can be addressed through the application of a logical analysis framework, i.e., the TDA, which in turn provides essential input into the compilation of a SAP.

**Strategic Action Programme for the BCLME**

The Strategic Action Programme being developed (BCLME SAP 1999) is in essence a concise document that outlines regional policy for the integrated sustainable management of the BCLME as agreed by the governments of Angola, Namibia, and South Africa. The SAP spells out the challenge (regional problems), establishes principles fundamental to integrated



**Figure 15.4** Results of the Transboundary Diagnostic Analyses (TDA): Overview of major transboundary problems, generic root causes, and areas requiring action in the BCLME.

management in the region, specifies the nature, scope, and timetable for deliverable management policy actions (based on TDA input), details the institutional arrangements (structures) necessary to ensure delivery, elaborates on wider cooperation (i.e., cooperation between the BCLME region and external institutions), specifies how the BCLME Programme will be financed during the start-up and implementation phase (five years), and outlines approaches to ensure the long-term self-funding of the integrated management of the BCLME.

Key details of the BCLME SAP are briefly as follows.

*The Challenge*

The legacy of fragmented management — inadequate planning and integration, poor legal frameworks and inadequate implementation of existing regulatory instruments, insufficient public involvement, inadequate capacity development, and inadequate financial support mechanisms — superimposed on a complex and highly variable environment have manifested themselves, for example, in the decline of fish stocks, nonoptimal utilization of



**Table 15.1** Synthesis matrix.

Perceived Major Problems	Transboundary Elements	Major Root Causes*	Activity Areas**
Decline in BCLME commercial fish stocks and nonoptimal harvesting of living resources	Most of region's important harvested resources are shared between countries, or move across national boundaries at times, requiring joint management effort.	1, 2, 3, 4, 5, 6, 7	A, B, (C)
Uncertainty regarding ecosystem status and yields in a highly variable environment	Environmental variability and change impacts on ecosystem as a whole, and poor predictive ability limits effective management. The BCLME may also be important to global climate change.	1, 2, 3, 7	A, B, C
Deterioration in water quality: chronic and catastrophic	While most impacts are localized, the problems are common to all three countries and require collective action to address.	2, 3, 4, 5, 7	C
Habitat destruction and alteration, including <i>inter alia</i> modification of seabed and coastal zone and degradation of coastscapes	Uncertainties exist about the regional cumulative impact from mining on benthos and ecosystem effects of fishing. Degradation of coastscapes reduce regional value of tourism.	2, 3, 5, 6, 7	A, C, (B)
Loss of biotic integrity (e.g., changes in community composition, species diversity, introduction of alien species) and threat to biodiversity, endangered and vulnerable species	Fishing has altered the ecosystem, reduced the gene pool, and caused some species to become endangered/threatened. Introduced alien species are a global transboundary problem.	1, 3, 5, 6	A, C, (B)
Inadequate capacity to monitor/ assess ecosystem (resources, environment, and variability thereof)	There is inadequate capacity in the region to monitor the resources and the environmental variability, and unequal distribution of the capacity between countries.	1, 2, 5, 7	A, B, C
Harmful algal blooms (HABs)	HABs are a common problem in all three countries and require collective action to address.	1, 2, 3, 6, 7	A, B, C
<p><i>*Main Root Causes:</i></p> <ol style="list-style-type: none"> <li>1. Complexity of ecosystem and high degree of variability (resources and environment)</li> <li>2. Inadequate capacity development (human and infrastructure) and training</li> <li>3. Poor legal framework at the regional and national levels</li> <li>4. Inadequate implementation of available regulatory instruments</li> <li>5. Inadequate planning at all levels</li> <li>6. Insufficient public involvement</li> <li>7. Inadequate financial mechanisms and support</li> </ol> <p><i>**Area Where Action Is Proposed:</i></p> <ol style="list-style-type: none"> <li>A. Sustainable management and utilization of resources</li> <li>B. Assessment of environmental variability, ecosystem impacts, and improvement of predictability</li> <li>C. Maintenance of ecosystem health and management of pollution</li> </ol>			

resources, increasing pollution, habitat destruction, threats to biodiversity, all of which have transboundary implications. The challenge is to halt the changing state of the BCLME and, where possible, reverse the process through the development and implementation of sustainable integrated management of the ecosystem as a whole. More specifically:

- Overexploitation of commercial fish stocks and the nonoptimal harvesting of living resources in the ecosystem are causes of concern, particularly as most of the important harvested resources are shared between countries and overharvesting in one country can lead to depletion of that species in another and changes to the ecosystem as a whole.
- Inherent high environmental variability in the marine system and associated uncertainty and poor predictability limits the capability to manage resources effectively. The challenge is to improve predictability of “events” and their consequences.
- Deterioration of water quality in the BCLME and associated problems are common to all three countries and require collective action to address. Catastrophic events (e.g., major oil spills, system-wide anoxia) can impact across geopolitical boundaries requiring sharing of expertise and technology.
- Habitat destruction, alteration and modification to the seabed and coastal zone, and degradation of coastal areas is accelerating. The regional cumulative impacts are unknown and need addressing to ensure sustainable resource utilization and tourism.
- Increased loss of biotic integrity and the introduction of alien species (e.g., ballast water discharges) threatens vulnerable and endangered species and biodiversity of the BCLME and impacts at all levels, system wide.
- There is inadequate institutional, infrastructural, and human capacity at all levels to monitor, assess, and manage the BCLME. Moreover, there is an unequal distribution of existing capacity.
- Harmful algal blooms occur in coastal waters of all three countries and all face similar problems in terms of impacts, monitoring, and management. Collective regional action is necessary.

#### *Principles Fundamental to Cooperative Action*

The following principles are being proposed for consideration by the three governments:

- Application of the precautionary principle.
- Promote anticipatory actions (e.g., contingency planning).
- Stimulate use of clean technologies.
- Promote use of economic and policy instruments that foster sustainable development (e.g., polluter-pays-principle).
- Include environmental and health considerations in all relevant policies and sectoral plans.
- Promote cooperation among states bordering the BCLME.
- Encourage the interests of other states in the southern African region.
- Foster transparency and public participation within the BCLME Programme.
- The three governments will actively pursue a policy of cofinancing with industry and donor agencies.

#### *Institutional Arrangements (Structures)*

It has been suggested that an Interim Benguela Current Commission (IBCC) be established to strengthen regional cooperation. Its Secretariat and subsidiary bodies could be fully

**Table 15.2** Maintenance of ecosystem health and management of pollution: Improvement of water quality (taken from BCLME TDA 1999).

Problems	Causes	Impact	Risks/Uncertainties
<p>C1. Deterioration in coastal water quality: Coastal developments and rapid expansion of coastal cities, much of which was unforeseen or unplanned, has created pollution "hotspots." Aging water treatment infrastructure and inadequate policy/monitoring/enforcement aggravates the problem.</p>	<ul style="list-style-type: none"> <li>• Unplanned coastal development</li> <li>• Chronic oil pollution</li> <li>• Industrial pollution</li> <li>• Sewage pollution</li> <li>• Air pollution</li> <li>• Mariculture</li> <li>• Lack of policy on waste and oil recycling</li> <li>• Growth in coastal informal settlement</li> </ul>	<ul style="list-style-type: none"> <li>• Public health</li> <li>• Reduced yields</li> <li>• Unsafe edible organisms</li> <li>• Changes in species dominance</li> </ul>	<ul style="list-style-type: none"> <li>• Few or no baseline data</li> <li>• Performance standards and thresholds</li> <li>• National commitment to capacity building</li> <li>• Cause-effect relationship</li> </ul>
<p>C2. Major oil spills: A substantial volume of oil is transported through the BCLME region and within it, and this is a significant risk of contamination of large areas of fragile coastal environments from major accidents, damage to straddling stocks and coastal infrastructure.</p>	<ul style="list-style-type: none"> <li>• Sea worthiness of vessels/equipment</li> <li>• Military conflict</li> <li>• Sabotage</li> <li>• Human error</li> </ul>	<ul style="list-style-type: none"> <li>• Coastline degradation</li> <li>• Mortality of coastal fauna and flora</li> </ul>	<ul style="list-style-type: none"> <li>• Recovery period</li> <li>• Cost recovery mechanism</li> <li>• Return to peace in Angola</li> </ul>
<p>C3. Marine litter: There is a serious growing problem throughout the BCLME.</p>	<ul style="list-style-type: none"> <li>• Growth of coastal settlements</li> <li>• Poor waste management</li> <li>• Little public awareness and few incentives</li> <li>• Illegal disposal from vessels</li> <li>• Poverty of coastal communities</li> <li>• Ghost fishing</li> <li>• Fishing discards</li> </ul>	<ul style="list-style-type: none"> <li>• Faunal mortality</li> <li>• Negative aesthetic impacts</li> <li>• Damage to fishing equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Accumulation zones</li> <li>• Illegal hazardous waste disposal</li> </ul>

Table 15.2 continued

Socioeconomic Consequences	Transboundary Consequences	Activities/Solutions	Priority	Anticipated Outputs
C1	<ul style="list-style-type: none"> <li>• Loss of tourism</li> <li>• Higher health costs</li> <li>• Altered yields</li> <li>• Reduced resource quality</li> <li>• Aesthetic impacts</li> <li>• Lowered quality of life</li> <li>• Loss of employment</li> </ul>	<ul style="list-style-type: none"> <li>• Transboundary pollutant transport</li> <li>• Migration of marine organisms, e.g., seals</li> <li>• Negative impacts on straddling stocks</li> <li>• "Hot spots" common solutions</li> </ul>	<ul style="list-style-type: none"> <li>• Develop standard environmental quality indicators/criteria</li> <li>• Establish regional working groups</li> <li>• Training in marine pollution control</li> <li>• Plan/adapt regional pollution monitoring framework</li> <li>• Establish effective enforcement agencies</li> <li>• Demo projects on pollution control and prevention</li> <li>• Joint surveillance</li> </ul>	<ul style="list-style-type: none"> <li>• Shared solutions for water quality management</li> <li>• Regional protocols and agreements</li> <li>• Improved pollution control</li> <li>• Socioeconomic uplift</li> </ul>
C2	<ul style="list-style-type: none"> <li>• Opportunity costs (e.g. tourism, fisheries, salt production)</li> <li>• Altered yields</li> <li>• Reduced resource quality</li> <li>• Aesthetic impacts</li> </ul>	<ul style="list-style-type: none"> <li>• Resource sharing for containment, surveillance, rehabilitation, etc.</li> <li>• Ramsar site protection (border wetlands)</li> <li>• Transboundary pollutant transport</li> </ul>	<ul style="list-style-type: none"> <li>• Port state control</li> <li>• Regional contingency plan development</li> <li>• Research/modeling of recovery periods</li> <li>• Public awareness of notification procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Regional contingency plan</li> <li>• Shared resources</li> <li>• Rehabilitation plans</li> <li>• Regional protocols and agreements</li> </ul>
C3	<ul style="list-style-type: none"> <li>• Loss of fishing income</li> <li>• Public health</li> <li>• Cleanup costs</li> <li>• Loss of tourism</li> <li>• Job creation in informal sector</li> </ul>	<ul style="list-style-type: none"> <li>• Transboundary transport</li> <li>• Loss of fishing income</li> <li>• Public health</li> <li>• Cleanup costs</li> <li>• Loss of tourism</li> <li>• Job creation in informal sector</li> </ul>	<ul style="list-style-type: none"> <li>• Litter recycling</li> <li>• Harmonization of packaging legislation</li> <li>• Public awareness</li> <li>• Port reception facilities</li> <li>• Regulatory enforcement</li> <li>• Standardized policies</li> <li>• Seafarer education</li> </ul>	<ul style="list-style-type: none"> <li>• Cleaner beaches</li> <li>• Education material/documents available regionally</li> <li>• Standardized policies and legislation on packaging/recycling incentives</li> </ul>

functional by January, 2001. Meanwhile, the three governments have signed the SAP and the GEF Council recently approved the funds for the BCLME Programme (approximately US\$ 15 million). As envisaged, the IBCC will be implementing the organization for the BCLME SAP and will be supported by advisory groups as necessary. The following initial advisory groups are likely to be:

- Advisory Group on Fisheries and Other Living Resources,
- Advisory Group on Environmental Variability and Ecosystems Health,
- Advisory Group on Marine Pollution,
- Advisory Group on Information and Data Exchange,
- Advisory Group on Legal Affairs and Maritime Law,
- Advisory Group on Industry and the Environment.

It is anticipated that the IBCC would regularly review the status and functions of the above advisory groups and also establish *ad hoc* groups to help implement the SAP. Within the IBCC, a Project Coordination Unit would play a key role in coordination, networking, communication and information exchange for the BCLME Programme. It has been proposed that three activity centers (one per country) be established to facilitate coordination within the partner countries and to serve as centers for specialist BCLME actions (e.g., resource assessment, methodology and calibration, regional environmental monitoring and networking, marine pollution, etc.).

### *Policy Actions*

The policy actions by and large build on and give effect to (*with deadlines*) the actions specified in the TDA that are necessary to address the suite of identified priority transboundary problems and issues. As full coverage of these is beyond the scope of this paper, we present here a few examples which still need to be agreed and approved by the three governments:

- Joint surveys and assessment of shared stocks of key species will be undertaken cooperatively between 2001–2005 to demonstrate benefits of this approach. The three countries endeavor to harmonize the management of the shared stocks.
- A regional mariculture policy to be developed by December, 2002.
- The three governments commit themselves to compliance with the FAO (Food and Agriculture Organisation of the United Nations) Code of Conduct for Responsible Fisheries (FAO 1995).
- A regional framework for consultation to mitigate the negative impacts of mining be developed by December, 2002, and mining policies relating to shared resources and cumulative impacts to be harmonized.
- A regional network for reporting harmful algal blooms to be implemented in 2002.
- Wastewater quality criteria for receiving waters to be developed by June, 2002, for point source pollution.
- A strategy for the implementation of MARPOL 73/78 in the BCLME region be devised by December, 2000.
- Existing data series and material archives to be used to establish an environmental baseline for the BCLME.

- A regional biodiversity conservation management plan and framework to be developed by December, 2003.
- A comprehensive regional strategic plan for capacity development and maintenance for the BCLME to be finalized by June, 2001.

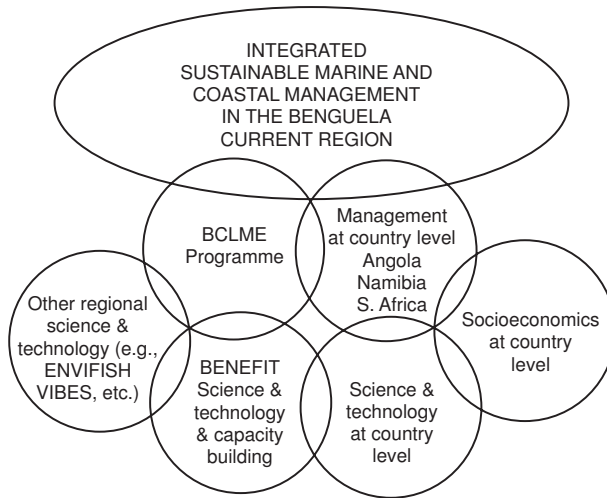
### *Wider Cooperation*

The three countries, individually and jointly, would encourage enhanced cooperation with other regional bodies such as BENEFIT, SADC (Southern African Development Community), the future South East Atlantic Fisheries Organization (SEAFO), NGOs, UN Agencies, donors, and other states with an interest in the BCLME.

## **CONCLUDING REMARKS**

We have attempted to illustrate the joint approach taken by Angola, Namibia, and South Africa in partnership, where appropriate, with the international community to manage the marine and coastal resources of the Benguela Current region sustainably through the application of science and technology. Examples have been provided of a fisheries science initiative, BENEFIT, country-based ICM, and holistic approach to regional marine and coastal management using the emerging BCLME Programme as the catalyst. These are some of the building blocks, but there are others. For example, at the science and technology level, strong links have been built with a number of parallel, but distinctly different, initiatives. These include (a) South Africa's established and internationally acclaimed Benguela Ecology Programme (BEP) (see Siegfried and Field 1982), which has resulted in the publication of thousands of publications on the Benguela ecosystem since 1982 (see, e.g., Payne et al. 1987, 1992; Pillar et al. 1998), (b) the ENVIFISH Programme (Environmental Conditions and Fluctuations in Distribution of Small Pelagic Fish Stocks), which is a three-year European Union funded project between seven EU states and Angola, Namibia, and South Africa focusing primarily on the application of satellite data in environment–fisheries research and management, and which commenced in October, 1998, and (c) VIBES (Variability of Exploited Pelagic Fish Resources in the Benguela Ecosystem in Relation to Environmental and Spatial Aspects), a bilateral French–South African initiative focusing on the variability of pelagic fish resources in the Benguela and the environmental and spatial aspects of the system, which also commenced in 1998. At the socioeconomic and management levels, bilateral arrangements between the three Benguela countries and various overseas states have materially assisted the development and application of sustainable management policies, while enhanced regional cooperation at all levels across disciplines is actively promoted by SADC. In the fisheries context, the future SEAFO is likely to play a pivotal role in the sustainable management of living marine resources.

In Figure 15.5 we have attempted to show how the various science and management initiatives fit together, both at the country level and regionally in the Benguela. Clearly, appropriate science and technology are the cornerstones of the integrated sustainable management. At all levels and in all disciplines and functions, strong emphasis has been placed on capacity development.



**Figure 15.5** Schematic showing the interlinking of science, technology, and management in the BCLME at country and regional levels.

The collaborative approach by Angola, Namibia, and South Africa is highly relevant within a broader regional context, i.e., within SADC, as it provides an example how member states with very different resource bases (human, infrastructure, financial) can work together using science and technology as a unifying factor to underpin responsible management of a complex system. Taken one step further it can help convert the vision of an *African Renaissance* into reality. More than that, we suggest that the approach and action by the countries bordering on the Benguela Current could serve as a blueprint in other parts of the developing world for the integrated sustainable management of marine and coastal systems which are shared between two or more countries.

### ACKNOWLEDGMENTS

What we have attempted to synthesize in this paper represents the collective wisdom and vision of a large number of local, regional, and international experts, and an example of the commitment by the governments of three southern African states to sustainable development and wise management of the region and its natural resources. In preparing this manuscript, we have drawn on published and unpublished documents as well as from the BCLME TDA and SAP and an article by L.V. Shannon and M.J. O'Toole entitled "The Benguela: Ex Africa Semper Aliquid Novi," which has been drafted for a book on large marine ecosystems edited by G. Hempel. We acknowledge permission given by the Windhoek Office of the United Nations Development Programme to use information from the TDA developed for the BCLME Programme and the invaluable input by Mr. C. Davis of the U.K. Department for International Development into the section dealing with ICM in South Africa.

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