

This article was downloaded by: [Food and Agricultural Organisation]

On: 22 May 2009

Access details: Access Details: [subscription number 907214387]

Publisher Taylor & Francis

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Coastal Management

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title-content=t713626371>

Benguela Current Large Marine Ecosystem—Governance and Management for an Ecosystem Approach to Fisheries in the Region

K. L. Cochrane ^a; C. J. Augustyn ^b; T. Fairweather ^b; D. Japp ^c; K. Kilongo ^d; J. Iitembu ^e; N. Moroff ^e; J. P. Roux ^e; L. Shannon ^f; B. Van Zyl ^e; F. Vaz Velho ^d

^a Food and Agriculture Organization, Rome, Italy ^b Marine and Coastal Management, Cape Town, South Africa ^c CAPFISH, Cape Town, South Africa ^d Instituto Nacional de Investigação Pesqueira, Luanda, Angola ^e Ministry of Fisheries and Marine Resources, Swakopmund, Namibia ^f University of Cape Town, Cape Town, South Africa

First Published on: 01 May 2009

To cite this Article Cochrane, K. L., Augustyn, C. J., Fairweather, T., Japp, D., Kilongo, K., Iitembu, J., Moroff, N., Roux, J. P., Shannon, L., Van Zyl, B. and Vaz Velho, F. (2009) 'Benguela Current Large Marine Ecosystem—Governance and Management for an Ecosystem Approach to Fisheries in the Region', *Coastal Management*, 37:3, 235 — 254

To link to this Article: DOI: 10.1080/08920750902851187

URL: <http://dx.doi.org/10.1080/08920750902851187>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Benguela Current Large Marine Ecosystem—Governance and Management for an Ecosystem Approach to Fisheries in the Region

K. L. COCHRANE,¹ C. J. AUGUSTYN,² T. FAIRWEATHER,²
D. JAPP,³ K. KILONGO,⁴ J. IITEMBU,⁵ N. MOROFF,⁵
J. P. ROUX,⁵ L. SHANNON,⁶ B. VAN ZYL,⁵
AND F. VAZ VELHO⁴

¹Food and Agriculture Organization, Rome, Italy

²Marine and Coastal Management, Cape Town, South Africa

³CAPFISH, Cape Town, South Africa

⁴Instituto Nacional de Investigação Pesqueira, Luanda, Angola

⁵Ministry of Fisheries and Marine Resources, Swakopmund, Namibia

⁶University of Cape Town, Cape Town, South Africa

This article examines the current status of management in the Benguela Current Large Marine ecosystem and the three coastal states in which it occurs: Angola, Namibia, and South Africa. The three countries have all focused on conventional approaches to fisheries management, concentrating on target species, and management has been largely centrally controlled. They have nevertheless made some progress toward addressing wider ecosystem issues. Scientific capacity has been generally good and scientific advice plays an important role in management decisions although the management capability varies between the countries. All have sufficient capability for ensuring sustainable fisheries but there are skills shortages in some areas. Based largely on a recent project to evaluate the feasibility of implementation of an ecosystem approach to fisheries in the region, the article evaluates the strengths and weaknesses of the current management approaches and identifies areas of concern. Limitations and threats to capacity, particularly in production of scientific advice and in management functions, are considered a major problem.

Keywords capacity, ecosystem approach, governance, large marine ecosystem, management, policies

Introduction

The Benguela Current ecosystem stretches along the south-west Atlantic coast of Africa from central Angola through Namibia to the south coast of South Africa, bounded by the Angola-Benguela Front in the north and the Agulhas Current in the South (from between roughly 14 and 17°S to between 36 and 37°S). It covers the West Coast of South Africa, the entire Namibian coast, and southern Angola to an extent depending on the position

L. Shannon was formerly with Marine and Coastal Management, South Africa.

Address correspondence to K. L. Cochrane, FAO, via delle Terme di Caracalla, Rome 00153, Italy. E-mail: kevern.cochrane@fao.gov

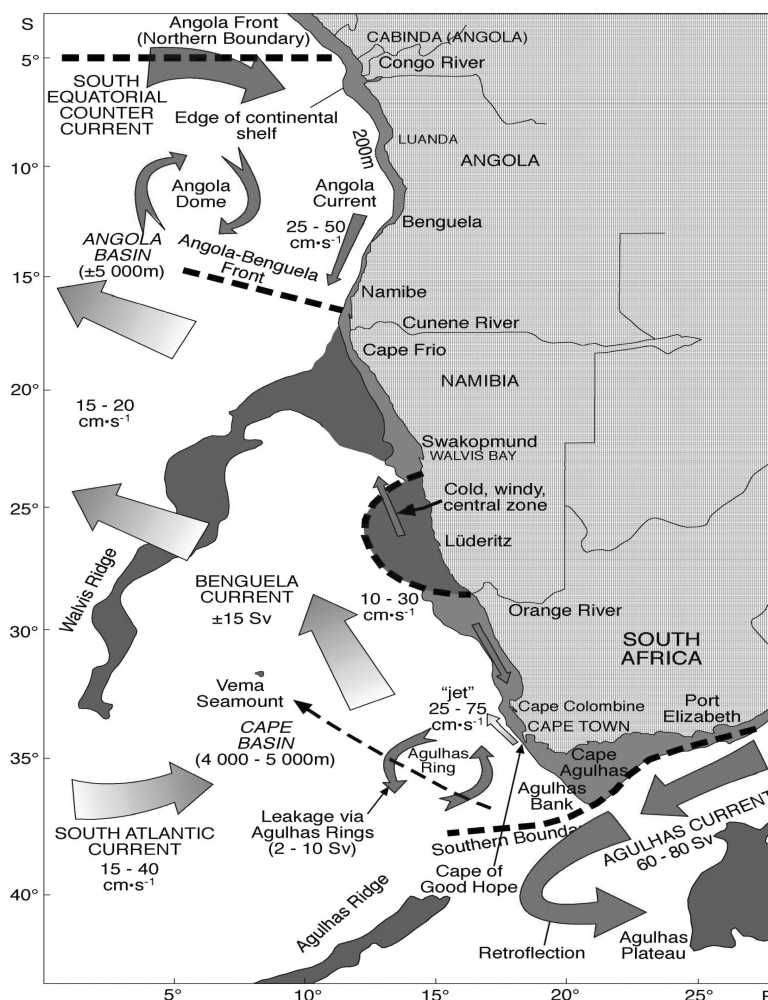


Figure 1. The boundaries, major currents, and physical features of the Benguela Current large marine ecosystem (BCLME, accessed from <http://www.bclme.org>).

of the Angola-Benguela front (Figure 1). In the political context, all three countries are in the midst of profound and far-reaching transitions. A ceasefire was declared in 2002 in Angola after 40 years of debilitating war. The country is now in the process of recovering and rebuilding but the needs are enormous: in 2002 the United Nations Development Programme (UNDP) ranked Angola at 166 out of 177 countries in terms of the human development index (Cardosa et al., 2006). Namibia and South Africa are still in transition after gaining independence (1990) and full democracy (1995), respectively.

The Benguela ecosystem is one of the most productive ocean areas in the world. Mean annual primary production has been estimated to be greater than $300 \text{ gC} \cdot \text{m}^{-2} \cdot \text{y}^{-1}$, which puts it in the category of Class I highly productive ecosystems and leads to high productivity in terms of fishery resources and dependent predators (UNDP, 2008). It is also highly complex in its oceanographic features (Figure 1), trophic structure, and human activities such as mining, oil extraction, and fishing, all of which impact its biodiversity and

Table 1

Some of the more important species, both fishery resources and of conservation concern, occurring in the BCLME and the countries sharing them (BCLME-EAF, 2006)

Species	Countries in which each species is found		
	Angola, Congo, Gabon	Angola, Namibia	Namibia, South Africa
Deep-water hake			X
Shallow-water hake			X
Longfin tuna			X
Snoek			X
Seabirds		X	X
Seals		X	X
Kabeljou & other linefish		X	X
Sardine/pilchard		X	X
Sardinellas	X	X	
Cunene horse mackerel	X	X	
Cape horse mackerel		X	X
Large-eye dentex		X	
Deepwater crab		X	X
Various sharks	X	X	X
Various other demersal species	X	X	X

BCLME = Benguela Current Large Marine Ecosystem.

ecosystem health. These human activities have substantial social and economic significance, providing important job opportunities and incomes for the three developing countries.

A significant feature of the Benguela Current is that many of the species are widely distributed within national exclusive economic zones (EEZs) and a number are considered to be distributed across national boundaries (Table 1). Given the wide distribution within EEZs, management of fisheries at present is generally at the national level rather than local but it is being increasingly recognized that for several stocks (mostly commercial) it should also be at the international (regional) level. Stocks for which at least some management functions could be delegated to the local level include mostly sedentary or limited mobility species such as abalone, inshore rock lobster, various other mollusks, and some other small-scale, less valuable resources.

The fisheries sector varies in relative importance between the three countries but makes significant social and economic contributions to national and local economies in all three. In a recent study, fisheries was reported as being the third-largest sector, in terms of economic value, in Namibia, coming behind agriculture and mining, with the industrial fishery generating up to 10% of the country's gross domestic product (GDP) in recent years (Sumaila et al., 2005). The industrial fishery consisted of some 335 vessels in 2002, 80% of which were Namibian flagged. Those vessels landed more than 600,000 tons of fish¹ in 2003 (Sumaila et al., 2005). Since then the number of vessels has declined substantially and was estimated to be less than 200 in 2007 (Moroff, MFMR Namibia, personal communication). The sector makes a significant contribution to employment, with about 15,000 people being employed, including 7,500 fishermen. As a result of the very harsh desert conditions along the coastline of Namibia, there is no significant artisanal

fishery in the country, although Fielding et al. (2006) suggested that there are fishers in Namibia's coastal communities who are licensed as commercial or recreational fishers but who would be classified as subsistence or artisanal fishers in other countries. In South Africa, the fishing sector provides employment, both sea-going and land-based, for about 26,000 people. The fishing industry contributes less than 1% of South Africa's GDP but is locally important, particularly in the Western Cape (approximately Cape Agulhas to Cape Columbine—Figure 1), where a number of coastal communities are directly or indirectly dependent on fishing for their livelihoods (Sauer et al., 2003). In Angola, the fisheries sector, consisting of both industrial and artisanal fisheries, is very important and ranks third in importance after oil and diamond mining. While the economic value of fishing is dwarfed by those two industries, it is an important source of employment and food to populations of the coastal regions and provides nearly half of the animal protein consumed by the human population. Domestic consumption of fish in Angola is the highest in the region, estimated to be about 11 kg per person per annum in 1994 (Sumaila et al., 2005). There are 102 fishing communities along the Angolan coast. Estimates vary but the most recent estimate is that 130,000 to 140,000 people engage in coastal artisanal fishing in Angola. This estimate includes those that are employed in fishing enterprises but excludes those who work in distribution and marketing of fish (Cardosa et al., 2006). In addition, there are approximately 25,000 fishers involved in large-scale fisheries.

The Need for an Ecosystem Approach

For much of the second half of last century, conventional fisheries management focused on sustainable use of the target resources and commonly gave little attention to the wider interactions between fisheries and the ecosystems in which they operated. In the last two decades, theory and policy have come to recognize the weakness of this approach. The need to implement an ecosystem approach to fisheries was recognized by the 47 countries participating in the Reykjavík Conference on Responsible Fisheries in the Marine Ecosystem in October 2001. The Declaration adopted by those countries was acknowledged and reinforced at the World Summit for Sustainable Development in Johannesburg in 2002, which developed a Plan of Implementation that included a pledge to “Encourage the application by 2010 of the ecosystem approach, noting the Reykjavík Declaration . . . and decision 5/6 of the Conference of Parties to the Convention on Biological Diversity” (Cochrane et al., 2004, 9).

For the purposes of this article, and the study on which it is based, the term “ecosystem approach to fisheries” (EAF) is used instead of ecosystem-based management, where EAF is defined as:

An Ecosystem Approach to Fisheries strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic, and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries. (FAO, 2003, 14)

The importance of including ecosystem aspects in fisheries management in the Benguela Current Large Marine Ecosystem (BCLME) countries has been recognized at national levels and an EAF has been adopted in the current fisheries policies. However, progress in implementation has been generally slow, although historically there have been many

national initiatives to address wider ecosystem issues in fisheries management. These have, though, tended to be reactive and lacking coordination (Cochrane et al., 2007).

The BCLME Programme, which ran from 2002 to January 2008 and was funded by Global Environmental Facility (GEF), had the overall goal of securing “the restoration and sustainability of the depleted marine fish stocks and associated degraded biodiversity of the Benguela Current Large Marine Ecosystem” (UNDP 2008, 1). As such it helped to facilitate and coordinate a major examination of the interactions between human use and impacts on the marine coastal environment and the ecosystem. The Programme concluded that fishing is having important impacts on the BCLME but that other natural and human activities are also having impacts on the ecosystem and its living resources. It noted that, with a strongly wind-driven coastal upwelling system, the BCLME undergoes marked environmental variability, leading to substantial variability in the abundance and availability of the fishery and other living marine resources. The Programme concluded that “chronic and catastrophic deterioration in water quality” is an important concern, that Harmful Algal Blooms (HABs) are a significant problem in all three countries, and that seabed mining and the petrochemical industry (in terms of both exploration and production) pose high pollution risks. The rapid rate of coastal development is also creating problems, in particular leading to local “hotspots” of pollution (UNDP, 2008). In addition, the Programme noted that the negative consequences of human impacts are likely to be reinforced by global climate change superimposed on natural ecosystem variability, substantially adding to the already profound difficulties of managing for sustainable use of the BCLME and its resources. All of these conclusions strengthen the need for an ecosystem approach to fisheries in the region with the integration of not only management regimes for the different activities (e.g., fishing, hydrocarbon exploitation, and pollution control) but also for greater cohesion between coastal states on common issues including but not limited to shared stocks.

In relation to the fishery resources, notwithstanding serious attempts at management in all countries, a number of the most important fishery resources in the region are currently over-exploited, including the hakes *Merluccius capensis* and *M. paradoxus*, sardine *Sardinops sagax*, and the Cape and Cunene horse mackerels *Trachurus capensis* and *T. trecae*. As one example of the consequences of such over-exploitation, Cardoso et al. (2006) reported that artisanal fishers in Angola had experienced a decline in the abundance of fish, which meant that they had to travel further and stay at sea longer in order to catch the same amount of fish as they had caught prior to this decline.

Nature of the “Ecosystem-Based Management” being Applied in the BCLME

The approach reflected in the policies of the coastal states of the BCLME is consistent with the definition of EAF provided in the previous section. All are developing countries that have critical short- and long-term social and economic needs and are striving to increase employment and incomes and improve on other indicators of urgently required human development. The countries emphasize the need for long-term conservation objectives and sustainable use of living natural resources and ecosystems but also recognize that these will only be practicable if the serious problems of poverty and equitable distribution of benefits are being simultaneously and effectively addressed, as reflected in the World Summit of Sustainable Development Plan of Implementation. Reconciling these diverse societal objectives is fundamental for sustainable use of fishery resources (Cochrane, 2008).

Goals and Objectives

While the three BCLME countries are and have been considering and implementing aspects of EAF for many years (see, e.g., Shannon et al., 2004), this article focuses mainly on a specific project that represented the first attempt by each of the three countries and, for the region as a whole, to consider implementation of EAF as a concept. The project was entitled “Ecosystem Approaches for Fisheries (EAF) Management in the BCLME: A Feasibility Study” and was undertaken as a joint activity by BCLME, Food and Agriculture Organization (FAO), and the three national fisheries agencies.² The objectives of the project were to investigate the feasibility of EAF management in the BCLME region through examining the existing issues, problems, and needs related to EAF, and to develop different management options to achieve sustainable management of the resources at an ecosystem level.

Current Policies and Management Processes

At present the fisheries in all three countries are managed at the national level, even in the case of stocks known to be shared. However, within the BCLME, there has been good progress toward cooperative management, including the recent establishment of the inter-governmental Benguela Current Commission (see later). There has also been a history of good research cooperation between the three countries over the last decade and more, particularly through the Benguela Environment Fisheries Interaction and Training Programme (BENEFIT) and the GEF Benguela Current Large Marine Ecosystem programme (BCLME programme).

All countries have policies that encompass an ecosystem approach to fisheries.

The Government of Angola has adopted a comprehensive set of objectives, considered by local officials to be consistent with EAF (BCLME-EAF, 2006), to be achieved over the next decade within the fisheries sector. These include to:

- guarantee the rational exploration of the aquatic biological resources within the limits of biological sustainability and to protect the aquatic environment;
- legislate for protection of aquatic biological resources and to ensure the effective application of the laws;
- create enabling mechanisms, including suitable financial and fiscal conditions, to encourage sustainable development;
- promote training, capacity building, and development of the necessary expertise in the fishery sector;
- promote the improvement of the economic infrastructure and the social basis of the fishery sector;
- promote the development of the artisanal fishery, the industrial fishing sector, and aquaculture;
- promote the reliable supply of fishery products to the population; and
- maximize the benefits from responsible use of living aquatic resources.

In Namibia, EAF is also entrenched in government policy governed by Chapter 11 of the constitution, under which article 95 (c) states that “The State shall actively promote and maintain the welfare of the people by adopting policies aimed at the maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of Namibians, both present and future.” Further, the Namibian Marine Resource Act No. 27 of 2000

aims (2) “To provide for the conservation of the marine ecosystem and the responsible utilization, conservation, protection and promotion of marine resources on a sustainable basis; for that purpose to provide for the exercise of control over marine resources; and to provide for matters connected therewith.” In addition, Namibia is a signatory to the FAO Code of Conduct for Responsible Fisheries and played a leading role in the development of the Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem, which demonstrate the commitment of Namibia to an ecosystem approach to fisheries (Roux & Shannon, 2004).

In the case of South Africa, the specific EAF objectives and principles in Chapter 1 (Section 2) of the South African Marine Living Resources Act No. 18 of 1998 include the following (MLRA, 1998):

- the need to achieve optimum utilization and ecologically sustainable development of marine living resources;
- the need to conserve marine living resources for both present and future generations;
- the need to apply precautionary approaches in respect of the management and development of marine living resources;
- the need to utilize marine living resources to achieve economic growth, human resource development, capacity building within fisheries and mariculture branches, employment creation, and a sound ecological balance consistent with the development objectives of the national government;
- the need to protect the ecosystem as a whole, including species that are not targeted for exploitation;
- the need to preserve marine biodiversity;
- the need to minimize marine pollution;
- the need to achieve to the extent practicable a broad and accountable participation in the decision-making processes provided for in this Act;
- any relevant obligation of the national government or the Republic in terms of any international agreement or applicable rule of international law; and
- the need to restructure the fishing industry to address historical imbalances and to achieve equity within all branches of the fishing industry.

These national policies have been picked-up and reinforced in the Interim Agreement on the establishment of the Benguela Current Commission,³ which has as a primary objective (Article 2, paragraph 1(a)) “to establish a formal institutional structure for cooperation between the Contracting Parties that will facilitate the understanding, protection, conservation and sustainable use of the Benguela Current Large Marine Ecosystem by the Contracting Parties. . .,” where the Contracting Parties are the governments of the three signatory countries.

The BCC includes an Ecosystem Advisory Committee with the following tasks:

- a. to support decision-making by the Management Board, the Ministerial Conference, and the Contracting Parties by providing them with the best available scientific, management, legal, and other information, and expert advice concerning the conservation and ecologically sustainable use and development of the Benguela Current Large Marine Ecosystem; and
- b. to build capacity within the Contracting Parties to generate and provide the information and expert advice referred to in (a) on a sustainable basis.

Indicators of Progress

In general, biological indicators have been established for the major commercial stocks of the BCLME region and applied in adapting effort levels and catch outputs, typically on an annual basis (e.g., Shannon et al., 2006; Fairweather et al., 2006). The most commonly used biological indicators include biomass estimated from fishery-independent surveys, commercial catch-per unit effort, fishing mortality rates, and various measures of length composition of the stocks (see, e.g., Fairweather et al., 2006; Geromont et al., 1999). In contrast, indicators of social, economic, and governance performance are poorly defined and, in general, not routinely measured or applied, although some attempts have been made to gauge progress in these areas (e.g., Branch & Clarke, 2006; Van Sittert et al., 2006). Despite this, in addition to biological considerations, the criteria used in selecting suitable harvesting strategies for the major commercial stocks usually take into account estimated annual average catch and inter-annual catch-variability, which provide a measure of expected outputs and stability in production for the fishing sector, both of fundamental social and economic interest (Cochrane et al., 1998; Geromont et al., 1999). Nevertheless, the lack of more explicit social and economic indicators has been a serious omission and needs to be addressed within the region as a whole if the national and regional policies discussed earlier are to be achieved.

Management and Governance

At the national level, approaches to management and the current efficacy of management vary between the countries and between the fisheries within each country but all three countries have adequate management and institutional systems in place to manage their fisheries (UNDP, 2008). Nevertheless, performance, in terms of delivery on objectives, varies from fishery to fishery within and between countries. In all three countries the management tends to be predominantly top-down and well-supported by scientific advice, albeit still largely stock-based and national in scope, although in all cases there is some measure of consultation with stakeholders. The general management environment and system in each country is summarized in Table 2. In all three countries, management is largely science-driven and effort and catch levels are based on regular assessments of the target stocks (see, e.g., Cochrane et al., 2004; Roux & Shannon, 2004; Shannon et al., 2006; UNDP, 2008).

The industrial fisheries in Angola, targeting small pelagic species, demersal finfish, and deep-water shrimp, are all closed access fisheries. The Ministry of Fisheries is responsible for issuing licenses. These fisheries are regulated through a combination of catch controls, in the form of total allowable catches, effort regulation, and technical measures (Kilongo, vaz Velho, and de Barros, personal communication). The southern region of Angola has been closed to bottom trawlers in an attempt to address the decline in biomass of Cunene horse mackerel. Total allowable catches are set annually by the Ministry of Fisheries based on scientific advice from the Angolan Fisheries Research Institute (INIP) and the total allowable catch (TAC) is divided up into quotas allocated to the license holders. The artisanal fishery also has a limited entry system, in that only members of fishing communities are allowed to fish but there is no overall limit on total effort or output. All industrial vessels allowed to operate in Angola must be equipped with a Vessel Monitoring System (VMS) but with existing capacity for monitoring, control, and surveillance (MCS), enforcement cannot be ensured along the entire coastline (Kilongo, vaz Velho and de Barros, personal communication). The current management measures have not been in

Table 2
Summary of some of the key characteristics of the management approaches to fisheries in the BCLME countries

Characteristic	Angola	Namibia	South Africa
<i>Management approach</i>	Largely top-down and centralized	Largely top-down and centralized	Largely top-down and centralized
<i>Nature of major resources</i>	Pelagic—only a few target species; Demersal—diverse, multi-species.	A few target species in all fisheries. Lowest species diversity among the 3 countries.	Pelagic—only a few target species; Demersal—multi-species, medium to high diversity. Inshore rock lobster, abalone and diverse linefish species. Historically dominated by large-scale, commercial but undergoing rapid, managed expansion of smaller-scale fisheries. Varies but most valuable stocks and resources are monitored by a combination of fisheries independent and fisheries derived methods.
<i>Scale of fisheries</i>	Mixed but with very large, coastal artisanal fishery sector.	Largely large-scale commercial fisheries.	
<i>Monitoring resources</i>	Fisheries-independent surveys are used for key pelagic and demersal resources.	Most valuable and important stocks and resources are monitored by a combination of fisheries independent and fisheries derived methods.	
<i>Access to resources</i>	Access to commercial fisheries is limited but artisanal fishery is effectively open access.	Access to all resources limited through system of access rights.	Access to all resources limited through system of access rights, which is still undergoing transformation. This is especially contentious in the inshore fisheries.
<i>Consultation mechanisms</i>	Informal	Informal	Informal
<i>Basis for setting management measures</i>	Scientific advice.	Scientific advice, formalized in OMPs in some cases.	Scientific advice, formalized in OMPs for major fisheries.
<i>Management measures</i>	Varies: TACs, effort control, gear restrictions, zonation. Little regulation of artisanal sector.	Varies: emphasis on TACs, also effort control, gear restrictions, zonation.	Varies: combination of TACs, TAE, capacity control, gear restrictions, zonation.
<i>Enforcement and compliance</i>	Requires substantial reinforcement.	Good but scope for improvement. Strives to have 100% observer coverage on all vessels.	Although there is a degree of self-enforced compliance within some industries, compliance for all sectors requires significant improvement in systems, distribution of manpower, and operational constraints.

place for long enough to assess their real effectiveness but there are some signs of recovery that may indicate that the current management measures are having a positive effect. However, the management system does not really control fishing mortality by the artisanal fleet, which currently accounts for 50% of the total landings of demersal species and this is likely to increase. Problems are being experienced with complaints by artisanal fishers that industrial vessels are not respecting the reserved zone within 4 miles of the coastline. This problem is being addressed and efforts to enforce the regulation are being intensified.

In Namibia, scientists from the Ministry of Fisheries and Marine Resources, after consultations with representatives of the fishing industry, recommend harvest levels and methods, based on the best scientific information available, to the Marine Resources Advisory Council. Additionally this council is also informed by the Directorate of Policy, Planning and Economics on the social and economic performance of the respective fisheries and the most likely consequences of management options taken. The council is chaired by the Permanent Secretary of the Ministry of Fisheries and Marine Resources and consists of various stakeholders with a strong representation by the fishing industry. The council recommends a management strategy to the Minister of Fisheries based on the information available. The Minister then decides on the management actions to be taken and advises Cabinet, where the final decision lies, on the total allowable catch and conditions for the right of exploitation. The implementation of the conditions is monitored by onboard Fisheries Observers and at the two ports, Walvis Bay and Lüderitz, by Fisheries Inspectors. Namibia is working toward a 100% Fisheries Observer coverage on all vessels operating in its territorial waters. Furthermore, a VMS has been implemented in 2007 to aid the Fisheries Inspectorate in law enforcement.

In South Africa, management decisions are based on scientific advice, largely but not exclusively related to the status of target stocks, generated by Scientific Working Groups (SWGs) through a process of research, research planning and integration, reporting, and debate. The Minister of the Department of Environmental Affairs and Tourism takes the ultimate resource management decisions. Thus, although science-based, several other considerations are taken into account in the process of fisheries management in South Africa. A comprehensive and highly transparent sector policy and rights allocation process was completed in 2005 for all commercial fisheries sectors. This is currently being followed up with a subsistence and small-scale fisheries policy development process, with rights due to be allocated by the end of 2008. There are currently problems with the implementation of monitoring, control, and surveillance, despite the fact that there is a scientific observer system in place. Sanctions for non-compliance tend to be patchy, with some notable, high-profile successes, but much non-compliance occurs on the coast and is increasing. Funding for fisheries compliance and research has recently been under pressure (mostly because of increasing vessel operating costs), but is expected to improve in the next few years. However, basic surveys and assessments are still carried out regularly. Management turnover is high, sometimes leading to lack of progress in learning and adaptation. Conflict resolution is not well developed and effective co-management forums are not yet fully developed, although there are plans to do so.

South Africa and Namibia have adopted innovative approaches to adaptive management in the use of operational management procedures (OMPs—e.g., see Butterworth et al., 1997; Geromont et al., 1999) in some of the major fisheries. Those fisheries are managed primarily by output control through total allowable catches, which are allocated as quotas. OMPs are used to set the TACs in the South African fisheries for hakes, small pelagics (anchovy and

sardine), and rock lobster. An OMP is used for the hake fishery in Namibia. An operational management procedure is

a set of clearly defined decision rules specifying: exactly how the regulatory mechanism, for example a total allowable catch (TAC), is to be set, typically on an annual basis; what data are to be collected for this purpose; and exactly how these data are to be analysed and used to this end. This set of rules is to be pre-agreed upon by the parties involved. . . . The set of rules is chosen by comparing the anticipated performance of a range of possible sets in terms of agreed performance criteria. . . . Comparison of performance allows explicit consideration of, and agreement upon, trade-offs between conflicting objectives. (Cochrane et al., 1998, 179)

Typically an agreed set of decision rules would be implemented for a period of 3–5 years and then evaluated and modified, in a consultative manner, as necessary. The use of OMPs in these cases has generally been successful, *inter alia* through providing a focus for good consultation with stakeholders (e.g., Cochrane et al., 1998).

While to date most or all cases of implementation of OMPs in BCLME fisheries have been based on largely single-species approaches and in the context of sophisticated stock assessments and computer simulation models, in the view of these authors, and as proposed by Shannon and Moloney (2004), the concept could readily be applied to multi-species fisheries or ecosystems as a whole with combined and complementary use of the best available scientific information. The immediate replacement of the single species stock assessments with a full ecosystem approach to management is clearly not practically feasible and could threaten stability and confidence in the short-term management of these resources. However, strategically, and in the best interests of the sustainability of these resources and the ecosystems of which they are an integral part, the medium- to long-term integration of an ecosystem approach in the management of the ecosystem as a whole is essential.

Effectiveness of Management

No rigorous evaluation has been undertaken of the national fisheries management systems in the BCLME countries and it has not been possible to undertake one for this article. However, Table 3 provides a preliminary summary of some aspects of performance, drawing mainly from the Risk-Assessment for Sustainable Fisheries (RASf) workshops undertaken within the BCLME EAF project (Shannon et al., 2006; Cochrane et al., 2007; Nel et al., 2007). Nel et al. (2007) compiled and grouped generic issues in a first attempt toward developing a tool for measuring and tracking progress in the implementation of EAF in Namibia and South Africa. Further work is also underway to use a fuzzy logic decision support system (Paterson et al., 2007) in the development of an EAF Implementation Tracking Tool (B. Paterson and S. Petersen, WWF-SA, personal communication).

Table 3 reflects the historical emphasis in the region on target species. It also shows that, while progress is being made, greater emphasis needs to be given to wider ecosystem issues such as ensuring that impacts on bycatch species are sustainable and addressing the impacts of fisheries on species of conservation concern and on ecosystem well-being as a whole.

Table 3
Preliminary analysis of current performance of fisheries management in relation to different goals

Broad issue	Angola	Namibia	South Africa
Status of the target species	Varies: small-pelagics generally good but others over-exploited or not known.	Horse mackerel reasonable but other major target species are below desired levels. Sardine and anchovy depleted.	Varies: small-pelagics healthy but variable. Some others over-exploited but management of fishing mortality aims to rebuild populations. The abalone fishery crashed and the inshore linefish target species are heavily over-exploited. Major retained bycatch species largely over-exploited. Others generally unknown.
Status of bycatch species (retained and discarded)	Unknown (not applicable in case of artisanal and demersal multi-species finfish fisheries).	Monkfish overexploited. Others unknown.	Concerns about the impact of the fishery on seabirds, turtles, and some sharks. Some action being taken (e.g., seabirds and turtles) but more required.
Attention to conservation species	Largely unknown. Frequently used for human consumption when caught.	Concerns about the impact of the fishery on seabirds, endemic sharks and skates, also fishery/seal interactions.	Impacts of fishing have been shown to have altered ecosystem structure (Watermeyer et al., 2008b).
Impacts of fishery on general ecosystem	Largely unknown.	Major concerns relate to the changes in trophic structure of the ecosystem through, in particular, very low abundance of small pelagics. Impacts of fishing have been shown to have altered ecosystem structure and functioning (Watermeyer et al., 2008a).	

Economic performance	Economic performance secondary to social contributions. Deep water crustaceans and some finfish economically important but benefits to Angolans could be improved. Low salaries, poor working conditions of women, poor infrastructure are some of problems in the sector.	Fishing makes substantial contribution to GDP. Considerable problems being experienced because of low biomass of key target species leading to reductions in jobs. Sector seriously impacted by current high fuel prices.	Generally a well-established and effective fishing sector. Important contributor to economies of some coastal towns. Likely to be performing well in economic terms. Currently being squeezed by high fuel prices.
Social performance	Fish provide essential protein for a large part of the population and important for coastal employment and livelihoods. A need to facilitate the creation of cooperatives has been identified.	Fishery sector very important source of employment but suffers from uneven distribution of income and high levels of unskilled, seasonal labor. Horse mackerel important for food security.	The process of transformation in access rights is making good progress toward achieving national social policies but still some dissatisfaction, especially among small-scale and artisanal fishers. Concerns about over-capacity in fishing fleets, lack of business skills, and capacity among small-scale fishermen. Generally sound but skills development and retention is a problem. Areas requiring improvement include communication with and participation by stakeholders, collection, and timely analysis of fisheries data. Enforcement is a problem in inshore fisheries.
Management structures and process	Making progress since the end of the civil war but still has important challenges to face. These include improvements in collection of reliable fishery data, strengthening monitoring and control systems, and development of formal management plans for the primary fisheries.	Historically sound but facing problems at present as capacity has declined in recent years. Areas that need to be strengthened include the development of formal management plans, enforcement and compliance, improving participatory processes and transboundary management of shared stocks.	
External impacts	Oil and gas extraction cause for concern but precise impacts unknown.	Generally minor but marine mining causes local problems.	Minor. Offshore oil may present problems in future.

Evolution of the Ecosystem Management Regime

A formal institutional analysis of the fisheries management regimes in each of the three countries has not been undertaken to the best knowledge of these authors. However, the BCLME-EAF project included an informal, participatory analysis as a part of the process of identification and prioritization of issues or problems that needed to be addressed in the implementation of EAF. The process consisted of participatory RASF workshops in which participants, guided by hierarchical trees including the three roots of “ecological well-being,” “human well-being,” and “ability to achieve,” were asked to identify any problems being experienced under the existing management regimes in the three countries and at the regional level. This exercise identified a number of institutional problems and needs that were subsequently extracted and reported (BCLME-EAF, 2007; Cochrane et al., 2007; Nel et al., 2007). Those results are summarized in Table 4.

The information shown in Table 4, and the full results from the RASF workshops (Shannon et al., 2006; Cochrane et al., 2007; Nel et al., 2007) demonstrated a number of concerns about the general management capacity in all three countries, both conventional (i.e., largely single-species or target-resource oriented) and for implementation of EAF. Namibia and South Africa both have histories of strong and effective conventional management underlined by strong scientific advice, but even this is currently being threatened by serious losses in human capacity without, to date, sufficient replacement. Van Sittert et al. (2006) concluded that the lack of capacity in fisheries management and administration in South Africa was the single biggest factor hindering good governance. They also referred to the shortage of well-trained and experienced black marine scientists to fill the current gaps and a worrying tendency to fill senior managerial positions with people without fisheries management experience. The institutional structures to accommodate such experience have, however, been established since 2006 and the current challenge is to retain skilled scientists and middle managers.

While each of the three countries is unique in the details of their capacity limitations, the South African problems of shortages of skilled staff are manifested in the other two countries as well. At the 3rd Regional Workshop of the EAF project (BCLME-EAF, 2007) it was concluded that lack of capacity was a critical factor in all three countries. This shortage applied particularly in relation to research and management but also in terms of policy, economics, and social sciences. The workshop was of the opinion that lack of capacity was a major constraint in the attempt to implement EAF.

Other conclusions arising from the workshop were:

1. in all countries there was a strong need to develop a resource management structure that would be suitable for EAF, included the main stakeholders and encompassed direct involvement of stakeholders in the decision-making process;
2. in Angola and Namibia there was a need to improve communications with the oil industry and marine diamond mining, respectively, as these activities were given precedence over fisheries at the political level;
3. there was a particular need to increase capacity for long-term ecosystem monitoring, placement of scientific observers, and improved data management;
4. in Angola improved surveillance and compliance and implementing a suitable system of access rights for the artisanal fisheries were critical;
5. while inadequate capacity was hindering effective fisheries management, the workshop agreed that EAF needed broad acceptance and lack of capacity should not preclude the implementation of EAF measures;

Table 4
Institutional needs and problems identified in the RASF workshops (summarized from Appendix 9 BCLME-EAF, 2007; Cochrane et al., 2007)

Issue	Angola	Namibia	South Africa
Management structures			
Stakeholder participation	<ul style="list-style-type: none"> — Need to improve participation in decision-making. — Reinforce and expand fishers' and producers' organizations. — Improve capacity of fisheries training institutions. 	<p>A need for improved transparency and wider representation in Marine Resources Advisory Council and working groups.</p> <p>Effective access rights in place but need for greater economic empowerment of Namibians.</p>	<ul style="list-style-type: none"> — Need to improve, including establishment of Resource Management Working Groups. — Co-management urgently required in rock lobster fishery. — Need to restore an effective advisory forum as per the MLRA (1998). <p>Maintenance of a database of rights-holders has now been completed. Access rights are the topic of on-going debate and evolution among small-scale and artisanal fishers.</p> <p>A record of the process of management decisions needs to be kept.</p> <p>No specific concerns were raised in the RASF workshops.</p>
Access rights	Need to improve procedure for allocation of access rights, especially in artisanal fishery.		
Management plans	Active management plans need to be implemented in all fisheries.	There are no formal, approved management plans in place.	
Inter-agency cooperation	<ul style="list-style-type: none"> — Need for integrated coastal area management. — A multi-sectoral working group should be established. <p>A regional working group should be established with Congo and Gabon.</p>	Poor—needs improvement.	
Cooperation beyond BCLME region		Not applicable.	Not applicable.
Information and research			
Data	<ul style="list-style-type: none"> — Information flow should be streamlined and improved. 	Inadequate and incomplete data capture and storage.	Concerns about the data system.
Research staff	<ul style="list-style-type: none"> — Training and career paths should be improved for scientists and managers. 	Problems in attracting and retaining qualified and experienced staff.	<ul style="list-style-type: none"> — Need for improvement in capacity after recent losses. — Variety of staff retention incentives required: financial, scientific career paths, etc. (currently being addressed, Augustyn, pers. comm.)

(Continued on next page)

Table 4

Institutional needs and problems identified in the RASF workshops (summarized from Appendix 9 BCLME-EAF, 2007; Cochrane et al. 2007)
(Continued)

Issue	Angola	Namibia	South Africa
Science and decision-making	— Implementation of operational management plans would be beneficial.	— Concerns relate to the absence of management plans with agreed reference points and need for clear terms of reference for working groups.	— Need for effective integration of science in decision-making (in relation to single species and EAF approaches). Need for clear research and development strategy and to increase capacity in social and economic research.
Information dissemination	Need for an education and awareness program with artisanal communities.	Improved communication to the general public.	— Need to increase awareness of stakeholders to EAF. — Improve access to information for public.
Legal			
	No specific concerns were raised in the RASF workshops.	Delays in filtering down from legislation to regulations and implementation.	— Greater use could be made of permit conditions for addressing implementation of EAF. — Need to re-establish environmental courts.
Monitoring, control, and surveillance (MCS)			
Enforcement	— Problems with motivation of fisheries inspectors. — Could involve local communities more in monitoring and surveillance. — VMS could be used	— Penalties for transgressions are not adequate.	— Increased resources for MCS required. — Problems in compliance at sea. — Need to increase capacity of fishery control officers and policing in general.
Observer coverage	Need for an on-board observer system.	Lack of observer coverage on smaller vessels.	Existing observer coverage needs to be continued and expanded.

6. single species approaches (SSA) were seen as an essential component of the fisheries management approach in the region but, for implementation of EAF, they needed to be broadened to include addressing ecosystem effects;
7. this broadening would require a “mind-shift” among researchers, managers, and industry.

At the regional level, the signing of the Interim Agreement for establishing the Benguela Current Commission was a very important step toward ensuring management of human impacts on the Benguela Current LME as a whole. The BCLME has a number of important fishery resources, species of conservation concern, and ecosystem processes that straddle at least one of the two political boundaries traversing the system and in some cases, both borders (see Table 1). The Commission will help to ensure cooperation over regional issues such as pollution, management of shared fish stocks, and regional steps to address, for example, the impacts of marine mining and oil and gas production on the environment. The signing of the agreement only occurred in 2007 and the Commission has not yet begun its work. The effectiveness of the Commission in practice will only be apparent in the years to come.

Conclusions

The BCLME as a whole is characterized by highly productive fisheries that, in the predominant, upwelling part of the ecosystem (southern Angola, Namibia and South Africa), are based on a relatively small number of widely distributed stocks. This leads to a need for national and multinational management regimes. There are, however, some notable exceptions, such as the West Coast rock lobster (although even in this case recruitment is from the widely distributed population rather than from local aggregations). Historically and at present, management has operated on national scales. As is clear from the preceding discussion, in the past, management has tended to be focused on the more economically important fisheries and the target species only and has been generally successful in Namibia and South Africa in achieving the goals associated with that approach (see the section “Effectiveness of Management”). This historical bias toward large-scale industrial fisheries is changing. In South Africa, the transformation process has led to a marked increase in small-scale operations in the fisheries for hakes and rock lobster as well as others. The authorities there are struggling to adapt to the changes in management approaches required by this transition, in particular the increased complexity of monitoring and control and the much larger stakeholder base, and this is being exacerbated by the general capacity problems. Angola has seen an even greater increase in artisanal fishers in recent decades, driven by major increases in the size of coastal populations. With the largest number of artisanal fishers of the three countries, by a wide margin, the country has an institute dedicated to artisanal fisheries (IPA—Institute for Development of Aquaculture and Artisanal Fishing). Among other initiatives, in 1998, IPA launched a program for the promotion and development of co-operatives for artisanal fishers. Namibia’s small-scale sector remains very small.

The record of success in the countries is currently being threatened by significant institutional problems. Paramount among these is a lack of retention of skilled scientists and managers in Namibia and South Africa, although the picture may be the reverse in Angola, which is rebuilding after many decades of war. Nevertheless, Angola also faces difficult institutional challenges. Other common institutional problems include inadequate stakeholder participation in management decisions and the need for a “mind-shift” that

broadens perspectives to encompass wider ecosystem issues, including engagement with other sectors interacting with the ecosystem and fisheries.

The increased demands of EAF are putting additional strain on the capacities of the BCLME countries as they face the challenges and shortfalls experienced by many developing countries. These include, in particular, a scarcity of suitable skilled personnel for research, management, and governance and, arguably, a predominantly short-term priority given at the political level to meeting immediate and substantial social, political, and economic needs. Nevertheless, as can be seen from the national and regional policies, all three countries accept and are committed to the need to implement an ecosystem approach in order to obtain the desired ecological, economic, and social goals in a sustainable manner.

Implementation is likely to continue in an incremental manner but, with the increased global and regional attention and the establishment of the Benguela Current Commission, with an even higher priority. The capacity problems present a substantial obstacle but, provided further reductions can be avoided, progress will still be possible. The greatest need and opportunity for improving delivery must lie in greater stakeholder participation, as identified in this study. That itself will require considerable capacity-building and awareness creation, a need that is well recognized by the countries.

In the face of limited capacity and the knowledge gaps, the countries and region as a whole will frequently be faced with a conflict between the need for proactive, precautionary management to address the highest priority ecological risks and the immediate, negative social and economic consequences that such action will often have. The political decision in each case will depend on the relative weights of the conflicting options and the ability to mitigate any substantive negative impacts on fishers and others dependent on fisheries. Wide-scale, sustained application of precautionary approaches to protect and rebuild resources and ecosystems across the three countries is therefore likely to be heavily dependent on the availability of alternative livelihoods for those adversely affected by necessary management actions and therefore on progress in social and economic development of the coastal regions as a whole.

Notes

1. Namibian fisheries with respect to volume are currently dominated by two species, horse mackerel and Cape hake.

2. Angola—Instituto de Investigacao Marinha, Ministério das Pescas; Namibia—National Marine Information and Research Centre (NATMIRC), Ministry of Fisheries and Marine Resources; South Africa—Marine and Coastal Management, Department of Environmental Affairs and Tourism.

3. [http://www.bclme.org/bcc/Interim%20BCC%20Agreement%20\(final%2016%20august%202006\).pdf](http://www.bclme.org/bcc/Interim%20BCC%20Agreement%20(final%2016%20august%202006).pdf)

References

- BCLME-EAF. 2006. *Annual Report January–December 2005*. Project LMR/EAF/03/01 Ecosystem Approaches for Fisheries (EAF) Management in the BCLME. FAO, Rome. 238 p.
- BCLME-EAF. 2007. *Report of the Third Regional Workshop*. Project LMR/EAF/03/01 Ecosystem Approaches for Fisheries (EAF) Management in the BCLME. Cape Town, South Africa, October 30–November 3, 2007. FAO, Rome. 225 p.
- Branch, G. M., and B. M. Clarke. 2006. Fish stocks and their management: The changing face of fisheries in South Africa. *Marine Policy* 30:3–17.

- Butterworth, D. S., J. A. A. DeOliveira, and K. L. Cochrane. 1997. Management procedures: A better way to manage fisheries? The South African experience. In *Global trends: Fisheries management*, eds. E. K. Pikitch, D. D. Huppert, and M. P. Sissenwine. *American Fisheries Society Symposium* 20:83–90.
- Cardosa, P., M. Sowman, and A. Duarte. 2006. Socio-Economic Baseline Survey of Coastal Communities in the BCLME Region—Angola. BCLME Report. 109 p. Available at <http://www.bclme.org/projects/docs/Final%20Report%20Component%20C%20-%20Angola.pdf> (accessed May 4, 2007).
- Cochrane, K. L. 2008. What should we care about when attempting to reconcile fisheries with conservation? In *Reconciling Fisheries with Conservation: Proceedings of the 4th World Fisheries Congress*, Vol. 1, eds. J. Nielson, J. J. Dodson, K. Friedland, T. R. Hamon, J. Musick, and E. Verspoor, 5–24. Bethesda, MD: American Fisheries Society.
- Cochrane, K. L., D. S. Butterworth, J. A. A. De Oliveira, and B. A. Roel. 1998. Management procedures in a fishery based on highly variable stocks and with conflicting objectives: Experiences in the South African pelagic fishery. *Reviews in Fish Biology and Fisheries* 8:177–214.
- Cochrane, K. L., C. J. Augustyn, A. C. Cockcroft, J. H. M. David, M. H. Griffiths, J. C. Groeneveld, M. R. Lipíński, M. J. Smale, C. D. Smith, and R. J. Q. Tarr. 2004. An ecosystem approach to fisheries in the Southern Benguela Context. *African Journal of Marine Science* 26:9–35.
- Cochrane, K. L., C. J. Augustyn, G. Bianchi, P. de Barros, T. Fairweather, J. Iitembu, D. Japp, A. Kanandjembo, K. Kilongo, N. Moroff, D. Nel, J.-P. Roux, L. J. Shannon, B. van Zyl, and F. Vaz Velho. 2007. Results and conclusions of the project “Ecosystem approaches for fisheries management in the Benguela Current Large Marine Ecosystem.” *FAO Fisheries Circular No. 1026*. Rome, FAO. 167 p.
- Fairweather, T. P., C. D. Van Der Lingen, A. J. Booth, L. Drapeau, and J. J. Van Der Westhuizen. 2006. Indicators of sustainable fishing for South African sardine (*Sardinops sagax*) and anchovy (*Engraulis encrasicolus*). *African Journal of Marine Science* 28:661–680.
- Fielding, P., P. Cardoso, and M. Sowman. 2006. Socio-Economic Baseline Survey of Coastal Communities in the BCLME Region—Namibia. Final Report of BCLME Project BCLME PROJECT LMR/AFSE/03/1/C. 67 pp. Available at <http://www.bclme.org/projects/docs/Final%20Report%20Component%20C%20-%20Namibia.pdf> (accessed August 6, 2008).
- FAO (Food and Agriculture Organization). 2003. The ecosystem approach to fisheries. *FAO Technical Guidelines for Responsible Fisheries*. No. 4, Suppl. 2. Rome, FAO. 112 p.
- Geromont, H. F., J. A. A. De Oliveira, S. J. Johnston, and C. L. Cunningham. 1999. Development and application of management procedures for fisheries in southern Africa. *ICES Journal of Marine Science* 56:952–966.
- MLRA. 1998. Marine Living Resources Act 1998. No 18 of 1998:1–64. Available at <http://www.info.gov.za/documents/acts/1998.htm> (accessed August 6, 2008).
- Nel, D. C., K. L. Cochrane, S. L. Petersen, L. J. Shannon, B. van Zyl, and M. B. Honig. 2007. Ecological risk assessment: A tool for implementing an ecosystem approach for southern African fisheries. *WWF South Africa Report Series—2007/Marine* WWF South Africa Report Series—2007/Marine. 203 p.
- Paterson, B., A. Jarre, C. L. Moloney, T. P. Fairweather, C. D. van der Lingen, L. J. Shannon, and J. G. Field. 2007. A fuzzy-logic tool for multi-criteria decision making for the pelagic fishery in the southern Benguela. *Marine and Freshwater Research* 58(11):1056–1068.
- Roux, J.-P., and L. J. Shannon. 2004. Ecosystem approach to fisheries management in the northern Benguela: The Namibian experience. In *Ecosystem Approaches to Fisheries in the Southern Benguela*, eds. L. J. Shannon, K. L. Cochrane, and S. C. Pillar. *African Journal of Marine Science* 26:79–93.
- Sauer, W. H. H., T. Hecht, P. J. Britz, and D. Mather. (2003). *An Economic and Sectoral Study of the South African Fishing Industry. Volume 2. Fishery Profiles*. Report prepared for Marine & Coastal Management by Rhodes University. Report for Department of Environmental Affairs and Tourism, South Africa. 308 pp.

- Shannon, L. J., and C. L. Moloney. 2004. Towards ecosystem-based fisheries management in the southern Benguela upwelling system. In *Ecosystem Approaches to Fisheries in the Southern Benguela*, eds. L. J. Shannon, K. L. Cochrane, and S. C. Pillar. *African Journal of Marine Science* 26:63–77.
- Shannon, L. J., P. M. Cury, D. Nel, C. D. Van Der Lingen, R. W. Leslie, S. L. Brouwer, A. C. Cockcroft, and L. Hutchings. 2006. How can science contribute to an ecosystem approach to pelagic, demersal and rock lobster fisheries in South Africa? *African Journal of Marine Science* 28:115–157.
- Shannon, L. J., K. L. Cochrane, and S. C. Pillar. Eds. 2004. Ecosystem approaches to fisheries in the southern Benguela. *African Journal of Marine Science* 26.
- Sumaila, U. R., G. Munro, and H. Keith. 2005. Benguela Current Commission (BCC) Economic Study. BCLME, Windhoek. 61 pp. Available at <http://www.bclme.org/projects/docs/PCU-BCC-04-02-Final%20Report.doc> (accessed August 6, 2008).
- United Nations Development Programme (UNDP). 2008. Implementation of the Benguela Current LME Strategic Action Programme for Restoring Depleted Fisheries and Reducing Coastal Resources Degradation. 141 pp. Available at [http://www.bclme.org/factfig/docs/SAP%20IMP%20Project%20Prodoc%20\(FINAL%2012%20Feb%2008\)1.doc](http://www.bclme.org/factfig/docs/SAP%20IMP%20Project%20Prodoc%20(FINAL%2012%20Feb%2008)1.doc) (accessed August 6, 2008).
- Van Sittert, L., G. Branch, M. Hauck, and M. Sowman. 2006. Benchmarking the first decade of post-apartheid fisheries reform in South Africa. *Marine Policy* 30: 96–110.
- Watermeyer, K. E., L. J. Shannon, J.-P. Roux, and C. L. Griffiths. 2008a. Changes in the trophic structure of the northern Benguela before and after the onset of industrial fishing. *African Journal of Marine Science* 32:383–403.
- Watermeyer, K. E., L. J. Shannon, C. L. Griffiths. 2008b. Changes in the trophic structure of the southern Benguela before and after the onset of industrial fishing. *African Journal of Marine Science* 32:351–382.