



AUTHORS:

Mark J. Gibbons¹ 
Bonga Govuza¹

AFFILIATION:

¹Department of Biodiversity and Conservation Biology, University of the Western Cape, Cape Town, South Africa

CORRESPONDENCE TO:

Mark Gibbons

EMAIL:

mgibbons@uwc.ac.za

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The nature of international collaboration in the Benguela upwelling region, 2000–2016

The aim of this piece is to draw attention to the fact that although we, as a country, have participated extensively in collaborative work with neighbouring states in the area of marine science, the number of lingering collaborations is woefully low, at least as measured using collaboratively authored publications as a measure of success in collaboration. And this low level of collaboration is despite significant financial intervention in the first decade of the 21st century. Indeed, the situation is depressing, and from conversations with colleagues, the lack of willingness to be inclusive and generous with authorship leads to mistrust and potentially threatens future relationships. With Operation Phakisa, the South African government is intent on building the blue economy, an economy that can best succeed by working with neighbours. With South Africa currently holding the chair of Indian Ocean Rim Association (IORA) and with the Department of Environmental Affairs Branch Oceans and Coasts investing significantly in research in the Western Indian Ocean, we need to be careful. So this piece is framed with the intention of reminding scientists who are working ‘collaboratively’, to make good on the fruits of the collaboration.

International collaboration occurs when scientists with different skill sets and/or knowledge/experience from different countries work together on a common subject/problem. International, regional collaborative research within the Benguela Current Large Marine Ecosystem (BCLME) was generously funded between 1997 and 2008, and has been supported subsequently, albeit at a lower level of investment. Collaboratively conceived and executed projects that generate data should result in collaboratively authored publications at project end, conditional upon data quality, subject novelty and time. Starting from a low level then, we would expect to see a progressive increase in collaborative publications pertinent to the BCLME region over the period 1997–2008, reflecting the stimulation and momentum engendered by the injected resources. As funds dwindle, a decline in collaboration might be anticipated that will be followed by a new base built on common curiosities and linkages. Here, we examine the level of collaboration in the scientific publications that emanated from work conducted in the BCLME over the period 2000–2016, with a view to understanding the nature of the collaboration.

The Benguela Current is one of five eastern boundary currents which characteristically flow equatorward along the western seaboard of the major continental land masses. These currents are renowned for their important industrial fisheries that contribute significantly to regional economies and have been subject to considerable study. While teams from across the world try to seek universal truths through comparative approaches¹, much is management orientated, and is conducted ‘in-country’². The Benguela Current flows northwards along the west coasts of South Africa, Namibia and southern Angola.³ Whilst the oceanographic environments off each country differ in details³, there are strong commonalities between them – not least of which are some mobile, transboundary resources³. These resources pose problems for sustainable management. In recognition of these problems, the large marine ecosystem (LME) concept was established⁴, the aim of which is to enable the collaborative, ecosystem-based management of resources within transnational areas. The LME relevant to the Benguela Current is the Benguela Current LME (BCLME).

To be successful, nation states within an LME need to work together and coordinate their research and management efforts. In the BCLME region, this research cooperation was initially coordinated through the BENEFIT (BENguela Environment, Fisheries Interaction and Training) programme.⁵ Conceived and developed between 1994 and 1996, BENEFIT was launched in 1997 with funding from the governments of South Africa, Namibia and Angola and with donor support primarily coming from NORAD (Norwegian Agency for Development Cooperation) and GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit). The programme drew in a number of other international partners including Iceland (through the Icelandic International Development Agency) and France (Institute of Research for Development).

The BCLME programme, which came into effect partway through the life of BENEFIT, started in 2002 with funding from the Global Environment Facility and the United Nations Development Programme, with financial inputs also from regional governments.⁶ Whilst many of the goals of the two programmes were similar, the end-point of the BCLME programme was the establishment of the Benguela Current Commission, which would oversee the joint management of transboundary issues. The Benguela Current Commission was set up in 2006, but only became entrenched via the signing of the Benguela Current Convention in 2013.

The BENEFIT and BCLME programmes were founded on two significant pillars. The first focused on research questions common to all of the regional maritime states, and local scientists developed projects around management needs facing at least two of them. Foremost amongst these projects were ones involved with transboundary fish stocks, although many other studies were conducted.⁷ The second pillar was capacity development^{5,6}, and efforts in this regard focused on building human capacity with a lesser emphasis on developing, bettering and maintaining national and regional infrastructure.

Whilst the BENEFIT and BCLME programmes of active research effectively terminated in 2008, a number of other collaborative research programmes were initiated. The National Research Foundation of South Africa has bilateral agreements with the governments of both Namibia and Angola, and projects in the marine sciences have been funded in the last 5 years. The German government funded the GENUS (Geochemistry and Ecology of the Namibian Upwelling System) programme for the period 2009–2015, and NORAD and the Food and Agricultural Organization of the United Nations have continued to sponsor ship’s time in the region. And of course, there are a number of regional management bodies, such as the International Commission for South-East Atlantic Fisheries, in which local scientists participate, and through which coordinated and collaborative research could be furthered.

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Materials and methods

We acknowledge that the fruits of research collaboration can be measured in many ways: as joint project and cruise reports published in the grey literature; joint presentations at symposia and workshops that never see the light of day beyond the book of abstracts; jointly formulated management decisions and changes to policy; increased technological and academic self-sufficiency and efficiency, etc. We also accept that some products of the same may get published as either books or book chapters. However, we have confined our assessment of collaboration to peer-reviewed scientific journal articles – the golden standard for most practising scientists.

A search for all peer-reviewed scientific journal articles published during the period 2000–2016 was conducted using Google Scholar, with Boolean operators and the keywords “Benguela, Angola, Namibia, South Africa, southern Africa, west coast, W coast, SW coast, Large Marine Ecosystem” and all variants thereof, e.g. “Angola or Namibia and Benguela”, or “South Africa and west coast”.

Publications were screened for relevance to the marine environment of the BCLME region, regardless of topic or discipline. Papers on taxonomy, biology, climate, geology, oceanography and management, as well as technology were therefore included. The publication details of each paper were captured and the following information culled from the author list and associated affiliations: number of authors, country of origin of the first author and country of origin of co-authors if different from that of the first author. Here, we assume that the first author is the lead author, although we accept this may not always be the case. In cases where authors shared affiliations between institutions owing to short-term secondments or exchanges (e.g. Institute of Research for Development, France and University of Cape Town, South Africa), the country of the home institution only, is considered. Each country was scored only once in a collaborative paper, if represented. The geographic location/focus of each study was assigned as northern Benguela (North of the Lüderitz upwelling cell), southern Benguela (South of the Lüderitz upwelling cell), or the whole BCLME region.

Results

Overview of the data

A total of 808 peer-reviewed journal papers were published on the environment and/or resources of the BCLME region over the period 2000–2016 (Supplementary table 1), averaging 48 annually (Table 1); there was no temporal trend in the data. The majority of papers were published with a focus on the southern Benguela, whilst the fewest were published on the whole of the BCLME (Table 1). There were significant differences in the mean number of countries collaborating together in the different regions ($F=4.37$, $d.f.=48$, $p<0.05$, Table 1), but no temporal change in the mean number of countries participating on papers in the different regions. Scientists from within a single country authored the majority of papers (48%), and colleagues from three or more countries published less than 17%. Regionally, South Africa dominated the single-country papers (57%), Namibia wrote nine (2%), whilst Angola wrote none (Supplementary table 2).

Regional collaboration

Approximately 71% of the papers involved regional authors, but only 12% have involved collaboration between scientists from two or more of the BCLME countries (Figure 1). Although there has been no temporal change in the numbers of publications per partnership (Figure 1), regionally collaborative papers that have been published with a focus on the northern Benguela have increased significantly with time ($R=0.53$, $p<0.05$, Figure 2); there is also some evidence to suggest that BCLME-wide papers too have been increasing post-2007. The level of regional collaboration has been highest in studies with a focus on the northern Benguela, and lowest in studies of the southern Benguela (Table 1).

The majority of the collaborations (88%) have been between two countries, and the dominant partnership has been between South Africa and Namibia (82%) (Figure 1, Supplementary table 3); this pattern of collaboration has not changed through time. Regional scientists have led only 420 (52%) of the collaborative papers produced overall through the period 2000–2016, with South Africa taking the lion’s share (376, 90%).

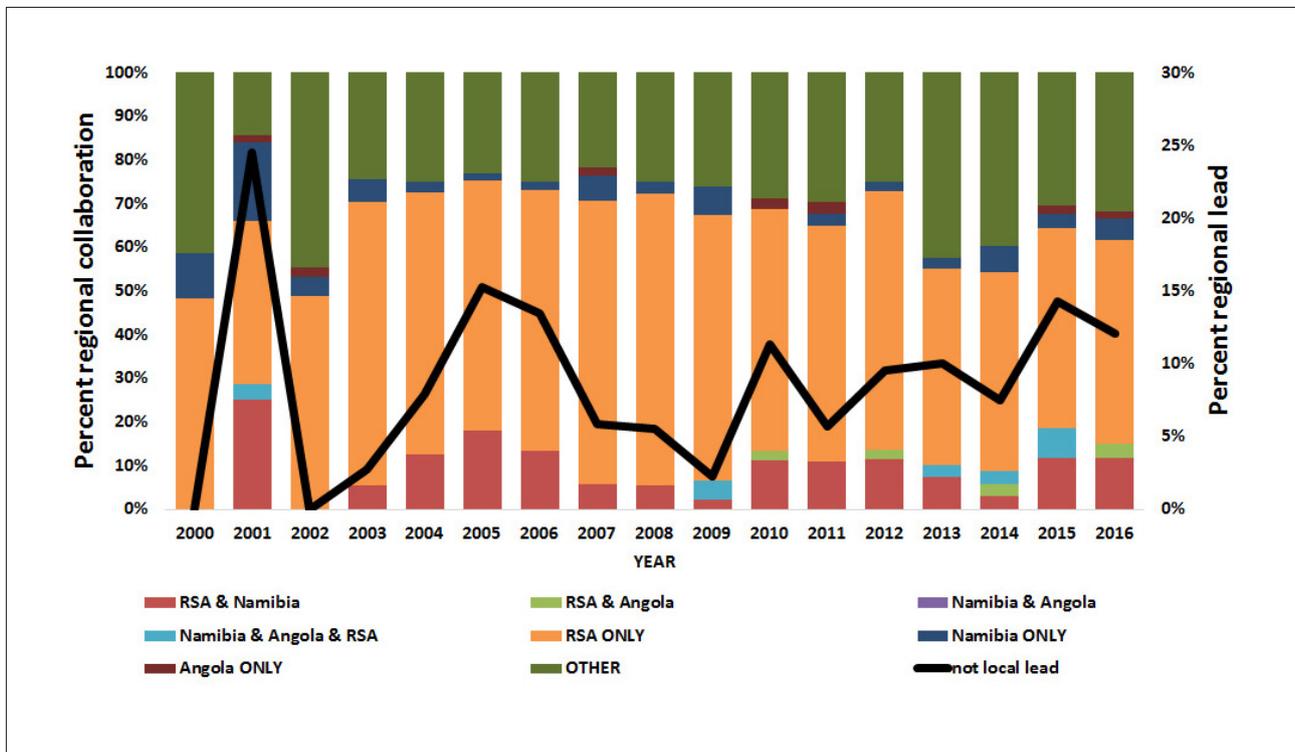


Figure 1: Per cent participation in peer-reviewed journal publications on the resources and/or environment of the Benguela Current Large Marine Ecosystem (BCLME) region during the period 2000–2016 by regional country in isolation, or collaboration. Also shown are the relative contributions that did not include a regional collaborator. Line shows per cent regionally led publications. Numbers of papers published each year from Table 1.

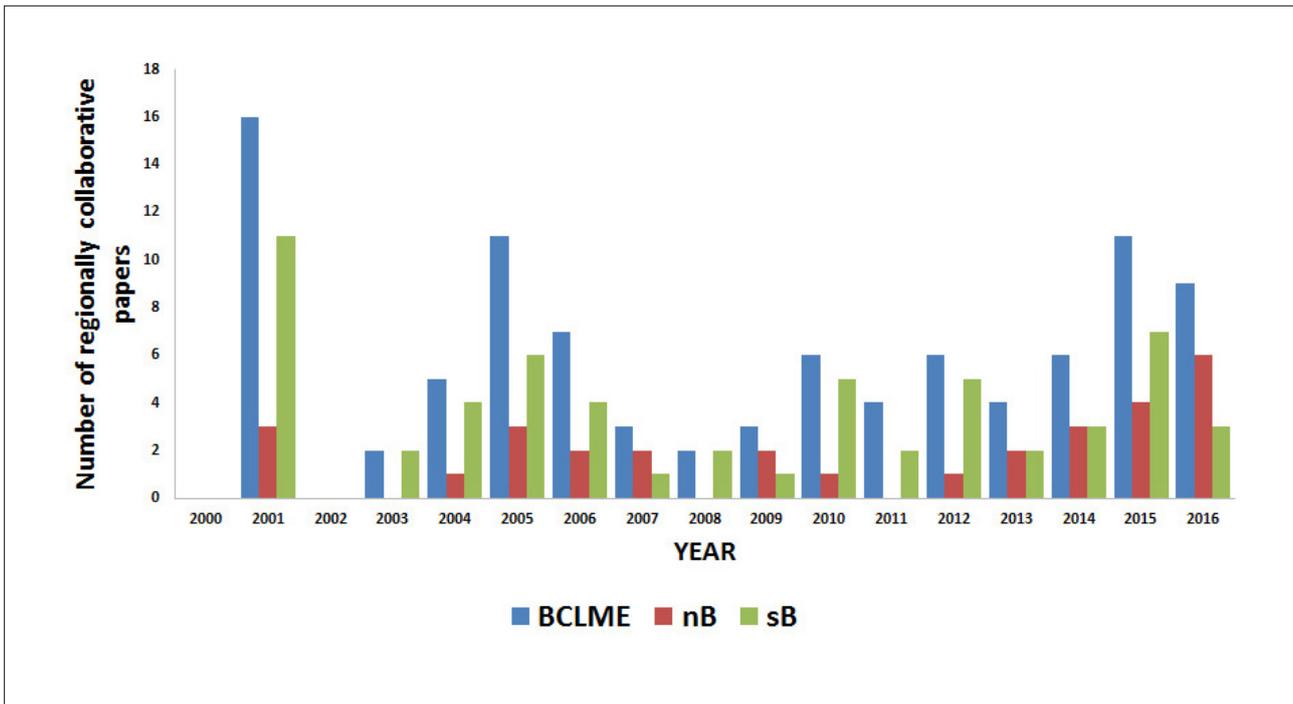


Figure 2: Temporal changes in the numbers of regionally collaborative peer-reviewed journal publications on the resources and/or environment of the Benguela Current Large Marine Ecosystem (BCLME) region over the period 2000–2016, by study focus area: BCLME, region wide; nB, northern Benguela; sB, southern Benguela.

Table 1: Number of papers (*N*) published on the resources and/or the environment of the Benguela Current Large Marine Ecosystem (BCLME) region over the period 2000–2016. Also shown are the average number of authors per paper and the average number of participating countries per paper. Data subdivided by study focus area: BCLME, region wide; nB, northern Benguela; sB, southern Benguela.

Year	<i>N</i>	Authors	Countries	<i>N</i>			Countries			Authors		
				BCLME	nB	sB	BCLME	nB	sB	BCLME	nB	sB
2000	29	3.21	1.45	3	16	10	1.33	1.56	1.30	3.67	3.44	2.70
2001	56	3.82	1.95	8	31	17	1.63	2.26	1.53	4.38	4.00	3.24
2002	47	3.62	1.49	15	13	19	1.47	1.38	1.58	3.53	4.46	3.11
2003	37	3.92	1.76	5	11	21	2.20	1.82	1.62	3.80	5.18	3.29
2004	40	3.75	1.78	3	17	20	2.33	1.94	1.55	3.33	3.94	3.65
2005	61	3.51	1.72	13	17	31	2.08	1.88	1.48	3.31	4.35	3.13
2006	52	3.62	1.73	9	15	28	2.22	1.60	1.64	3.89	3.07	3.82
2007	51	3.55	1.55	10	17	24	1.30	1.65	1.58	3.80	3.06	3.79
2008	36	3.94	1.78	7	6	23	1.86	1.67	1.78	5.00	4.17	3.57
2009	46	4.59	1.93	9	11	26	2.44	1.82	1.81	6.89	4.09	4.00
2010	45	4.44	1.82	9	16	20	1.56	1.94	1.85	3.56	4.63	4.70
2011	37	4.49	1.78	4	14	19	1.25	2.00	1.74	2.50	4.36	5.00
2012	44	4.39	1.91	9	12	23	1.67	2.17	1.87	3.22	4.92	4.57
2013	40	4.73	1.63	6	17	17	2.50	1.53	1.41	5.50	4.53	4.65
2014	68	4.15	1.79	13	26	29	2.15	1.69	1.72	4.69	4.00	4.03
2015	59	4.8	1.86	13	19	27	2.31	2.21	1.41	6.00	4.16	4.67
2016	60	4.87	1.8	14	20	26	2.14	1.90	1.54	6.50	4.15	4.54



Approximately 43% of South Africa's publications in the region over the period under study did not involve any collaboration outside the country, and of the balance, only 18% were conducted with Namibia and/or Angola affiliated colleagues (Supplementary table 3). In other words, researchers in South Africa were best at working with themselves and chose to collaborate with non-regional partners on regional science. By contrast, Namibia and Angola depended heavily on collaboration. In the case of Namibia, only 7% of their outputs were generated 'in-country', and of the balance, 70% was conducted with regional collaborators: the comparative figures for Angola were 0% and 71%, respectively.

These figures clearly vary geographically. Few Namibia- and no Angola-based scientists have collaborated with South Africa based scientists on any studies with a focus on the southern Benguela, although South Africa has worked with its northern neighbours on *all* regionally collaborative papers in both the northern Benguela and the BCLME region as a whole. There is an obvious geographical bias to the data: all of the Angolan-led papers have focused on the northern Benguela, as too have 81% of the Namibian-led papers, and 72% of South African led papers have been conducted in the southern Benguela. In terms of actual numbers, however, South Africa has led more papers on the northern Benguela than has Namibia (Supplementary table 3).

International collaboration

A total of 40 non-regional countries have co-authored papers in marine science with a focus on the resources or environment of the BCLME over the period 2000–2016 (Supplementary table 2). Of these, co-authors from Germany, France, the UK and the USA have each contributed to more than 10% of outputs, with Norway participating in ~9% (Supplementary table 2). Notably, Germany has published more articles on the region than Namibia has, and most of the single-country papers produced by scientists from Germany were based on data collected in the northern Benguela (Supplementary table 2). The BCLME region as a whole was the focus of single-country papers from France and the USA, and in both these cases, scientists worked more on the southern Benguela than northern Benguela (Supplementary table 2). Overall, fewer non-regional, single-country studies were conducted in the south than the north (Supplementary table 2). Indeed, when we exclude South Africa's authored or co-authored publications, the majority of the international work has been conducted in the northern Benguela (62%) or has been based on BCLME-wide studies (24%).

The major collaborations between countries publishing on the environment and/or resources of the BCLME region over the period 2000–2016 are shown in Supplementary tables 3 and 4. There are many details in these tables, but the standout features include the facts that the biggest collaborators of German-based scientists were other German-based scientists, the biggest collaborators of French-based scientists were those affiliated to South Africa, and the latter were significant collaborators also with UK-, US- and Norwegian-based scientists. It is noteworthy that after South Africa, Norway was the greatest collaborator with Namibia and Angola (Supplementary table 3). When we consider the level of collaboration by country of the first author, the patterns change only subtly (Supplementary table 4).

Overall, German collaboration with the region was poor: 29% when expressed as a percentage of all Germany's outputs and only 51% when expressed with reference to non-'in-country' papers. By contrast, the comparative figures for Norway were 84% and 91%, respectively, whilst for France, they were 70% and 80%, respectively.

Discussion

A number of factors influence national research productivity, as measured by the publication of peer-reviewed journal articles.^{8,9} Given these factors, it is not surprising to note that South Africa published more papers on the resources and/or environment of the BCLME region over the period 2000–2016 than either Namibia or Angola.

The number of publications with a focus on the BCLME as a whole or on the northern Benguela, penned by regional co-authors, has increased since 2007, supporting the idea that with financial intervention, regional

research collaboration can be fostered. However, it is not widespread because the number of outputs is low and it would be interesting to examine further the motivations of the authors concerned.

Whilst the southern Benguela focus of South Africa's research may explain why the majority of South African publications excluded Namibian and Angolan co-authors, the disappointing fact remains that South Africa did not, and does not, collaborate extensively with neighbouring LME maritime states. And this despite the fact that the initial Science Plans for the BENEFIT and BCLME programmes were conceived, and co-authored, by scientists from all three countries. Indeed, it would appear that South Africa preferred to collaborate with non-regional partners. By comparison, Namibia and Angola rely heavily on out-country colleagues, reflecting perhaps a lack of other international collaborators, in contrast to South Africa. However, they are not as disappointing as the comparative figures for some of the foreign investors and partners. After all, a part of the BCLME is on the doorstep of South Africa, but is many thousands of nautical miles away for these other nations. Research for foreign nations in the BCLME, unless based on published data or historical samples, requires access to regional waters and therefore government authority.

In South Africa, the letter of permission authorising research by a foreign vessel within 'the EEZ, the Territorial Waters and the Contiguous Zone' does not stipulate formal collaboration. That said, a copy of the cruise report is requested, as too is a set of the duly collected data. Foreign nations often provide opportunities for human capacity development, usually on board the vessel and often using equipment that local scientists otherwise have no, or limited, access to. Whilst this willingness to train can be seen as altruistic (it comes at a cost to the funder and is not a permit condition), it is frequently a prerequisite imposed by the foreign, grant awarding body. In developing countries, human capacity development is always welcome. However, the training provided may not always be appropriate to regional needs, matching, as it invariably does, the expertise available on the vessel. Importantly, however, the IP that has gone into the science of the cruise is almost exclusively foreign: *meaningful*, locally sourced IP is rarely incorporated into either the science agenda or the detailed science plans *from the outset*.

In order to manage the science practice, it is argued that we need to know the worth of individual practitioners. The measurement of individual worth is fraught, but increasingly we are using metrics that variously combine numbers of publications and citations, etc. Disentangling individual worth from multi-author publications can be problematic. As a consequence, many journals now provide detailed guidelines to assist authors in determining who should be included as a co-author and who should simply be acknowledged. Of these guidelines, intellectual inputs around study design and conceptualisation are arguably most significant, although contributions to writing and data analysis are also valued.

Given this, is the lack of regional authorship in foreign-led science publications understandable? We would argue not, although we accept that the generation of new knowledge that can be used to better understand and/or manage our regional environment/resources is good, regardless from where it originates. The too-strict adherence to journal guidelines regarding authorship builds a level of frustration, distrust and resentment amongst local scientists who feel, rightly or wrongly, that they should be party to it, and in the long term, it could threaten the harmony of future research collaborations.

If you cast your mind back to your first peer-reviewed scientific publication, you will remember the excitement. When your work began to get cited, there was a feeling of worth and belonging. Out-of-country regional collaborators that are involved in the meaningful collection of data deserve to be included amongst the authors of collaborative research efforts, if for no other reason than a formal recognition of contribution. There may be very good reasons why collaborators may not have been able to get involved in the writing (language and confidence) or data analysis (lack of capacity), time constraints aside, and an understanding of these is important. The inclusion of collaborators on the author list comes at no reputational cost, yet it builds confidence and a willingness to collaborate in future. Further, we would argue, capacity development aimed at building teams of authors is likely to be more beneficial in the

long term than the acquisition of new skills that go unused. Such would go some way to legitimising collaborative authorship in the minds of the authorship purists.

Many of the issues raised above reflect differences in collaborator capacity, about which much has been written.^{8,9} The most successful, meaningful, lasting and inclusive collaborations are built around projects that focus on a common problem, and which are conceived and initiated together.¹⁰ A series of protocols has been developed to assist partners in the development of truly meaningful collaborative projects^{11,12}, and these protocols are being implanted by a number of funders across the world. It is not our intention here to repeat the recommendations proposed in these aforementioned documents, but we make a plea for regional scientists, and scientists interested in working within the region, to engage with this literature and begin to adopt the principles enshrined within it. Whilst the BENEFIT and BCLME programmes have been rightly hailed as successes^{7,13}, there is much room for improvement if we are to move forward in a more equitable way, as regional nations.

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References

1. Fréon P, Aristegui J, Bertrand A, Crawford RJM, Field JC, Gibbons MJ, et al. Functional group biodiversity in Eastern Boundary Upwelling Ecosystems questions the wasp-waist trophic structure. *Prog Oceanogr*. 2009;83:97–106. <https://doi.org/10.1016/j.pocean.2009.07.034>
2. Punt A. Selecting management methodologies for marine resources, with an illustration for southern African hake. *S Afr J Mar Sci*. 2014;12:943–958. <https://doi.org/10.2989/02577619209504754>
3. Hutchings L, Van der Lingen CD, Shannon LJ, Crawford RJM, Verheye HM, Bartholomae CH, et al. The Benguela Current: An ecosystem of four components. *Prog Oceanogr*. 2009;83:15–32. <https://doi.org/10.1016/j.pocean.2009.07.046>
4. Sherman K. The Large Marine Ecosystem Concept: Research and management strategy for living marine resources. *Ecol Appl*. 1991;1:349–360. <https://doi.org/10.2307/1941896>
5. Shannon LV, Hampton I. BENEFIT Science Plan. Windhoek: BENEFIT Secretariat, Ministry of Fisheries and Marine Resources; 1997.
6. BCLME. Strategic action plan. Swakopmund: BCLME Secretariat, Ministry of Fisheries and Marine Resources; 1999.
7. Hampton I, Barange M, Sweijd N. Benguela Environment Fisheries Interaction and Training Programme (BENEFIT) research projects. *GLOBEC Report*. 2009;25:1–126.
8. Boshoff N. South–South research collaboration of countries in the Southern African Development Community (SADC). *Scientometrics*. 2010;84:481–503. <https://doi.org/10.1007/s11192-009-0120-0>
9. Pouris A. A scientometric assessment of the Southern Africa Development Community: Science in the tip of Africa. *Scientometrics*. 2010;85:145–154. <https://doi.org/10.1007/s11192-010-0260-2>
10. Organisation for Economic Cooperation and Development (OECD). Research co-operation between developed and developing countries in the area of climate change adaptation and biodiversity. Paris: OECD; 2014. p. 29.
11. Organisation for Economic Cooperation and Development (OECD). Opportunities, challenges and good practices in international research cooperation between developed and developing countries. Paris: OECD; 2011. p. 22.
12. Dodson J. Building partnerships of equals: The role of funders in equitable and effective international development collaborations. London: UK Collaborative on Development Sciences; 2017. p. 45.
13. Hampton I, Sweijd N. Achievements and lessons learned from the Benguela Environment, Fisheries, Interaction and Training (BENEFIT) research programme. *Afr J Mar Sci*. 2008;30:541–564. <https://doi.org/10.2989/AJMS.2008.30.3.9.643>