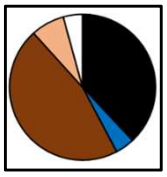
Addressing critical competence gaps in marine science - a personal Southern African perspective

Mark J Gibbons

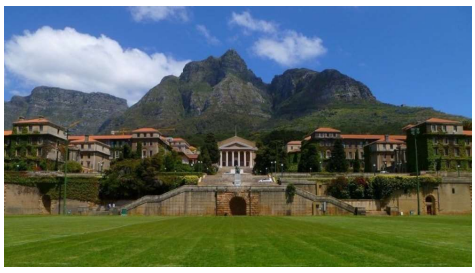
Education and competence building not unique to fisheries…

Education and competence building is not unique to international partnerships…

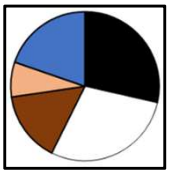
UWC

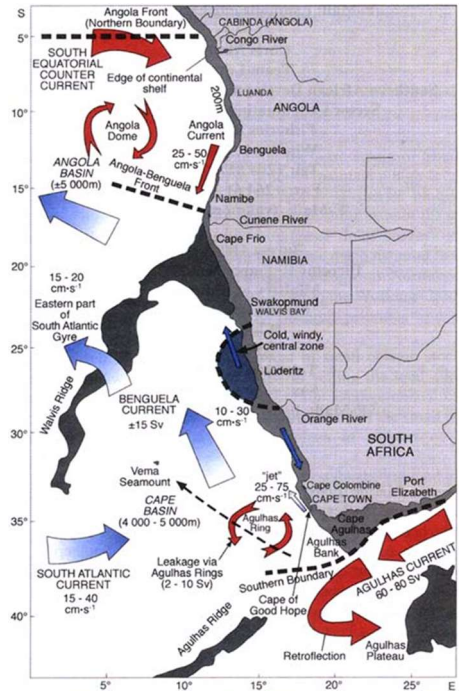


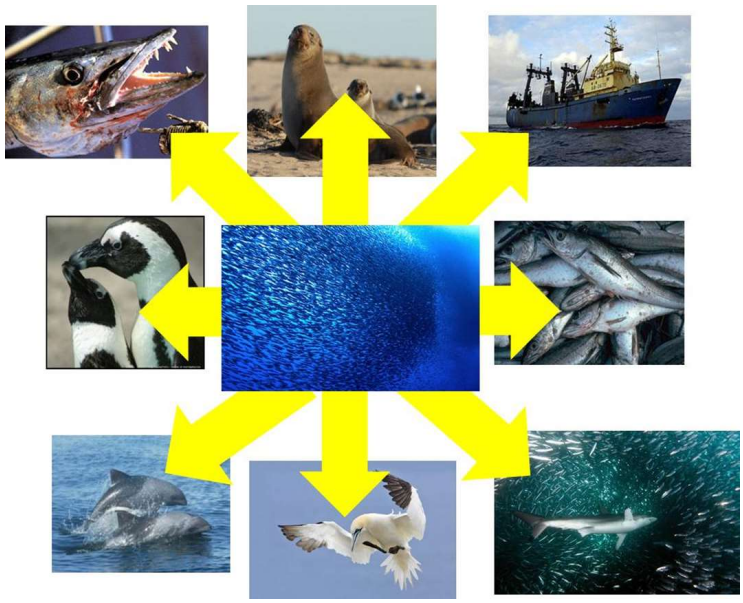
US

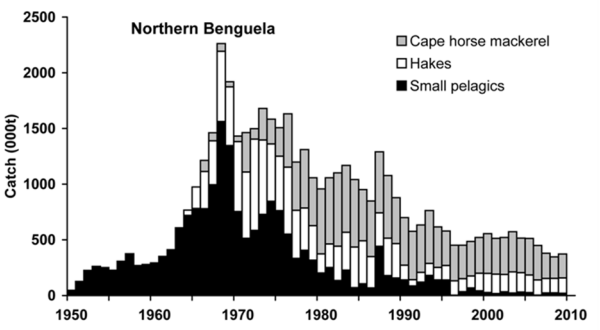


UCT





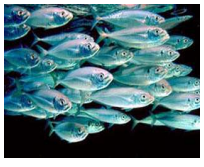


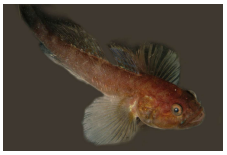


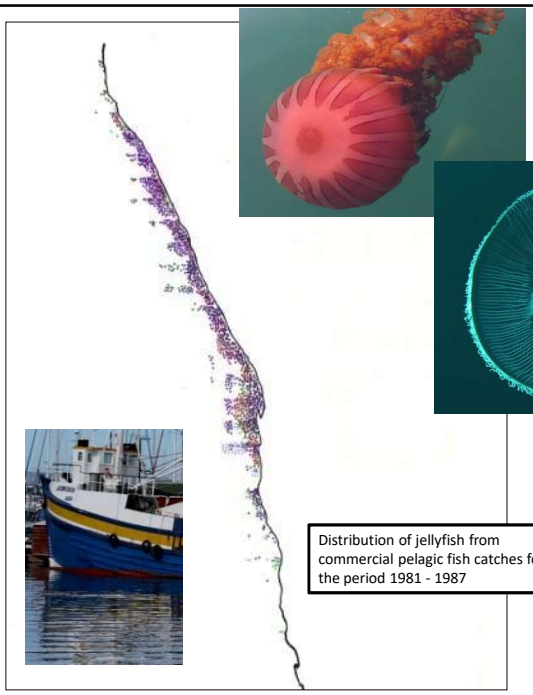
Annual combined catches of small pelagic fish, Cape hakes, and Cape horse mackerel In Benguela ecosystem, 1950–2010, in thousands of metric tons

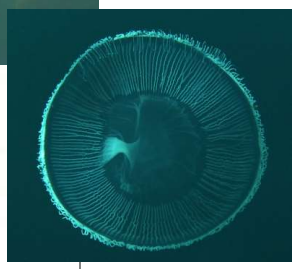
Losers

Winners

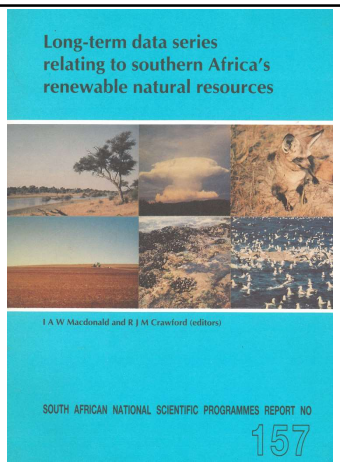








Distribution of jellyfish from commercial pelagic fish catches for the period 1981 - 1987



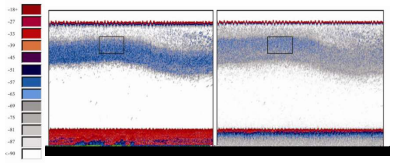
OCCURRENCE OF JELLYFISH ON THE WEST COAST OFF SOUTH WEST AFRICA/NAMIBIA

G E VENTER
South West African Directorate of Sea Fisheries

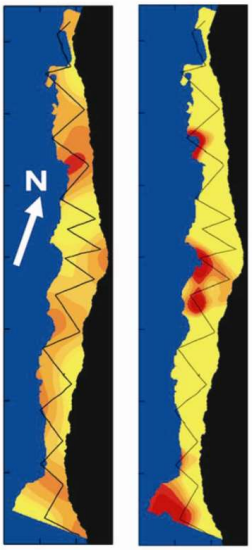
INTRODUCTION

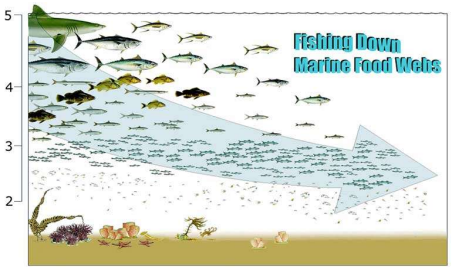
The abundant occurrence and wide distribution of jellyfish off the coast of South West Africa (Namibia) is a well known phenomenon, especially after the dramatic decrease in pelagic fishing in 1972. Jellyfish are present throughout the year. Two species in particular create a problem for commercial purse-seine fishermen, namely *Chrysoara hyoscella* (Linne 1766) and *Aequorea aequorea* (Forskal 1775).

BENEFIT



Typical daytime 38 kHz (left panel) *and* 120 kHz (right panel) echograms showing the distinct scattering layer due to *C. fulgida:* September 1999 – *Dr Fridtjof Nansen*





THE ROYAL SOCIETY

"…… in the heavily exploited northern Benguela off Namibia….. jellyfish biomass (12.2 million tonnes (MT)) now exceeds the biomass of once-abundant fish (3.6 MT)."

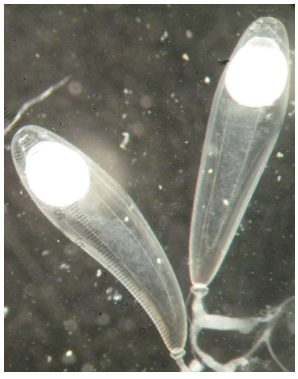
BENEFIT

The Research Council of Norway

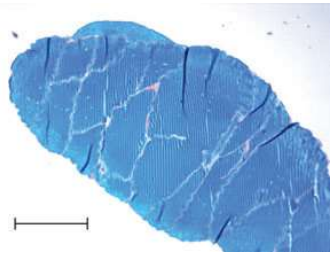
NRF

BCLME
Benguela Current Large Marine Ecosystem Programme

What we know now

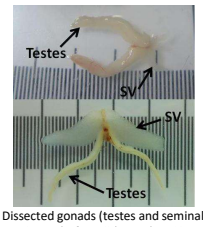


Ellipsoid shaped eggs of bearded goby. Image indicates the basal pole of the egg that is attached on a stalk with adhesive filaments.

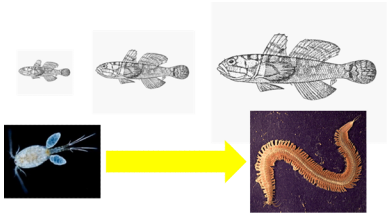


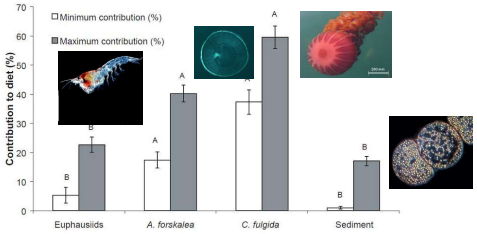
Cross sections of sperm duct gland (SDG) of male *Sufflogobius bibarbatus*, 140 mm TL. Chambers are highly extended and their lumina filled with secretion, reacting positively to alcian blue-PAS (pH 2 ‣ 5).

Two territorial males fighting. They are displaying by puffing up their oral cavity and by displaying all fins - to look as big as possible.

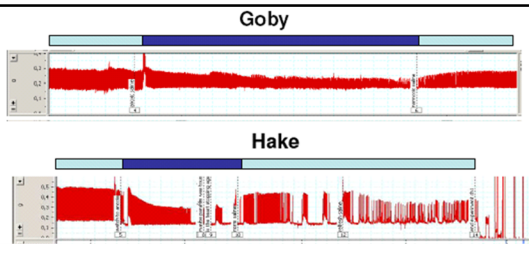


Dissected gonads (testes and seminal vesicles, SV) of small (upper) and large (lower) bearded gobies.

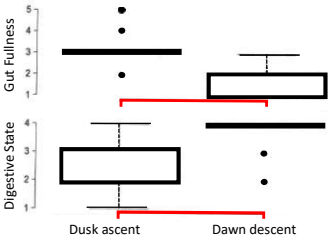




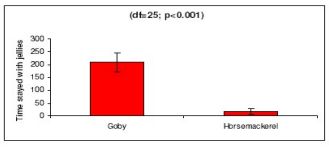
Isotope analyses showing maximum and minimum contribution of euphausiids, jellyfish and sediment to the diet of *S. bibarbatus*, as determined by a four end-point Isosource model (based on C and N) (20). Bars denote mean ± SEM. Bars with identical letters were not significantly different from each other at an α-level of 5%

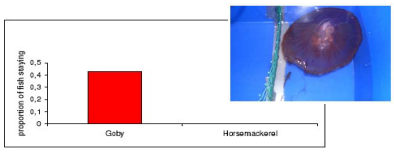


Goby (upper) and hake (lower) heart force before (under the light blue line), during (under the darker blue line) and after (under the light blue line) exposure to anoxia.



Box and whisker plot showing difference in degree of gut fullness and digestion, for fish ascending from bottom to the pelagic at dusk or returning to the bottom at dawn. *Gut fullness score is graded from 1 (empty) to 5* (full). Digestion score is graded from 1 (undigested) to 4 (fully digested). Thick line is the median; box is the interquartile range; whiskers are maximum and minimum; dots are outliers. No box or whiskers means there is little variability in the data.





Gobies choose to associate with jelly, while h/mackerel avoid jelly (upper), Gobies move across the mash divider or stay with the jelly, while all horse mackerel move away from the jelly (lower)

MONTH	Gobies	Horse Mackerel
JANUARY	11.88	1.03
FEBRUARY	2.38	1.08
MARCH	7.72	1.11
APRIL	9.88	1.09
MAY	6.37	0.77
JUNE	3.77	0.99
JULY	1.48	1.11
AUGUST	3.43	0.39
SEPTEMBER	--	0.70
OCTOBER	--	0.25
NOVEMBER	--	1.67
DECEMBER	--	0.82
AVERAGE	5.86	0.92

Monthly likelihood of catching gobies and horse mackerel with jellyfish, as oppose to catching them without jellyfish: Walvis Bay, 1991-2006, N>11 000

Was the collaboration a success?

NEWS OF THE WEEK

ECOLOGY

How a Little Fish Keeps Overfished Ecosystem Productive

From a food-web perspective, jellyfish are typically considered a dead end. Few organisms are thought to eat them, so they tend to sink to the ocean bottom, where they slowly decay, their carbon and energy wasted. But off the coast of southwest Africa, researchers have discovered that a small fish called the bearded goby feasts on jellies, and in doing so, helps to sustain seabirds, mammals, and larger fish in that ecosystem. On page 333, they describe this fish's unusual lifestyle, which includes hiding out on the muddy sea floor in water toxic to other fish. "An interesting and counterintuitive new food web [was] created by the [recent] jellyfish bloom," says Roberto Danovaro of the Polytechnic University of Marche in Ancona, Italy. "Certainly similar mechanisms are happening in many places, likely as a result of the ecosystem shift[s] related to global change and direct anthropogenic impacts."

Until the 1970s, this 9000-square-kilometer region off the coast of Namibia was a rich fishery, particularly for sardines. It's the site of the northern Benguela upwelling, where deeper, nutrient-rich water periodically flows coastward, promoting the growth of plankton. Filter-feeding sardines kept the plankton under control, but as overfishing depleted the sardine stocks, dying plankton sank to the bottom and decayed, using up almost all of the oxygen in the water and creating a so-called dead zone. Jellyfish gorged on the now-abundant plankton, and their numbers exploded.

At the same time, the numbers of bearded goby, *Sufflogobius bibarbatus*, a big-headed fish that grows to about 13 centimeters, increased. With sardines gone, the goby became the main prey of the hake and horse mackerel, as well as food for seabirds, penguins, and seals. Mark Gibbons of the University of the Western Cape in Cape Town, South Africa, and his colleagues were curious about how the goby is able to thrive in such an inhospitable ecosystem. They recruited two goby experts, Anne Utne-Palm and Anne G. V. Salvanes of the University of Bergen in Norway, to help make sense of this little fish.

Gibbons, Utne-Palm, Salvanes, and a cadre of students did a series of field and lab studies of the goby's habits and habitat. They also characterized the water column, assessing the oxygen content and amount of hydrogen sulfide at various depths. "The various elements combine to tell a compelling story," says Andrew Brierley, a marine ecologist at the University of St. Andrews in the United Kingdom.

Most of the region's sea bottom is covered by a thick mud rich in hydrogen sulfide and the bacteria that utilize this toxic gas. Little life exists in the bottom 20 to 60 meters of water, where oxygen levels are less than 10% of the expected level. The goby's predators, for example, can't survive there.

But echo soundings and trawling over a 24-hour period indicated that's where the gobies hang out during the day, Gibbons, Utne-Palm, Salvanes, and their colleagues report. Tests in aquaria with low levels of oxygen showed that these fish stop pumping water and oxygen over their gills in this hostile environment, in a sense holding their breath. Then at night, they ascend to where oxygen levels are higher, catch up on their breathing, and spend time with jellyfish and other organisms.

Many fish, including one of the goby's predators, the horse mackerel, avoid jellyfish. But fishers find jellyfish associated with bearded goby six times more frequently than other fish, says Utne-Palm, and in the lab, gobies frequently hang out among a jellyfish's tentacles or on its bell. She thinks by swimming among the jellyfish, the goby shields itself from potential predators. Its thick, slimy skin may protect it against jellyfish stings.

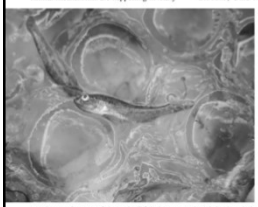
The jellyfish apparently provide more than shelter: When the researchers examined the stomach contents of gobies and the stable isotope ratios of their tissue—which mimics that of the food they consume—they found that jellyfish represent up to 60% of the goby's diet. Up to a third of the rest comes from sulfur-containing bacterial mats on the sea floor or other components of the mud. The stomachs were often full of diatoms and worms called polychaetes. "It's feeding on things that usually fish don't feed on," says Utne-Palm. "They are bringing dead-end products back into the ecosystem, making the ecosystem more productive than it would be otherwise."

What gets eaten on the bottom gets digested later on, when fish then reoxygenate their tissues. Fish caught at the bottom had undigested stomach contents, whereas those caught at night had begun to process what they had eaten.

Lab experiments also showed that a low oxygen level doesn't impair gobies' behavior or damage their heart the way it does their predators. These fish can also survive what for other organisms are intolerable concentrations of hydrogen sulfide, perhaps by not breathing at all in its presence. "This goby can deal with both low oxygen and with jellies and hence loves the new environment we have created for it, by fishing the heck out of everything else," says Daniel Pauly, a fisheries biologist at the University of British Columbia, Vancouver, in Canada.

Utne-Palm thinks this new food web is fairly stable and that sardines will not make a comeback anytime soon. But at least the goby is helping to keep the new ecosystem productive. "Nobody could have predicted," says Gibbons, "that an insignificant little fish could have turned out to save the day—or at least stabilized the day for us."

–ELIZABETH PENNISI



Caught together. Most fish avoid jellyfish, but not the bearded goby, which hides in and eats them.

268 16 JULY 2010 VOL 329 SCIENCE www.sciencemag.org

Development needs – relevant, deployable skills!

Infrastructure…

Barriers

Jobs & Strategy…… the case of marine animal eco-physiology

Government departments…

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Applications must be submitted on form Z83 and should be accompanied by a comprehensive CV and original certified copies of qualifications, ID copies and other relevant documents in order to be considered, to **The Director-General, Department of Environmental Affairs, Oceans & Coasts, P.O. Box 52126, V&A Waterfront, 8002 / 2 East Pier Shed, East Pier Road, Waterfront, 8002**. Take note that the Department will verify all qualifications and experience and that original documents must be submitted on appointment and all qualifications obtained abroad will be evaluated by SAQA.

The National Department of Environmental Affairs is an equal opportunity affirmative action employer. It is our intention to promote representivity (race, gender and disability) in the Department through the filling of these posts and candidates whose appointment / promotion / transfer will promote representivity will receive preference. Short listed candidates will be subjected to screening and security vetting to determine the suitability of a person for employment. Correspondence will be limited to successful candidates only. If you have not been contacted within 3 months after the closing date of this advertisement, please accept that your application was unsuccessful.

FOR ATTENTION : Human Resource Management

CLOSING DATE : **26 August 2011**

POST : **ENVIRONMENTAL OFFICER PRODUCTION GRADE C: ESTUARIES MANAGEMENT (OC 06/2011)**

SALARY : R 193 260 – R 245 241 per annum

CENTRE : **Waterfront – Cape Town**

REQUIREMENTS : A 4-year degree or diploma in the field of Natural Science/ Nature Conservation/ Environmental Management, with some evidence of practical capabilities in these fields. The position requires a person with good working knowledge of environmental legislation and a good understanding of the value and functioning of estuaries including challenges to their management. Good communication and report writing skills. Problem solving skills and the ability to work within tight deadlines. Ability to independently analyze policies, environmental data and review environmental impact assessment applications/reports in and around estuaries. Possession of a valid driver's licence is essential, as the job requires frequent traveling.

….Assist in the process for the development and implementation of estuarine management plans through familiarization with estuarine issues across the board, including biophysical, socio-economic and legislative aspects. Assist with the management of estuaries by participating in local, regional and national meetings; and also undertaking site visits on behalf of the department and reporting on activities undertaken. Support interventions to stop environmentally unsuitable developments and support suitable ones through commenting on EIA applications and reports. Liaise with other sub-components and directorates…….

The University of KwaZulu-Natal (UKZN) is committed to Employment Equity

COLLEGE OF AGRICULTURE, ENGINEERING AND SCIENCE

PROFESSOR/ASSOCIATE PROFESSOR (MARINE BIOLOGY)
SCHOOL OF LIFE SCIENCES
WESTVILLE CAMPUS

REFERENCE NO.:LS04/2014

The School of Life Sciences is well established with a strong research profile and has a large number of undergraduate and postgraduate students. The incumbent will make valuable contributions to the teaching and research leadership in Marine Biology.

S/he will be expected to promote interdisciplinary research across the School and College and between the different marine institutions in the region, in addition to international collaboration.

The incumbent should be an established international expert in his/her field, capable of leading a dynamic multidisciplinary research team in the school. In addition s/he will provide leadership in the School and the College and develop the next generation of academics. S/he should also play a leading role in improving the teaching in the School and College. S/he should preferably diversify existing teaching and research expertise in Marine Biology at the University.

The incumbent will report to the Dean and Head of School.

Minimum Requirements:

- A PhD degree in any area of Estuarine/Marine Biology or Ecology
- Experience in teaching in a relevant field at Tertiary Institution
- Demonstrated ability to attract external research funds
- A strong research focus as evidenced by a current and sustained research record of publications in peer-reviewed ISI/ DoHET accredited journals appropriate for the level
- Successful supervision of postgraduate students including at least a PhD student in a relevant field of study

Apparent strategy….

10 years ago…..



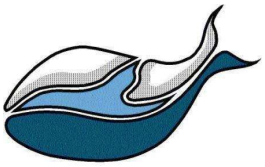
Today….






We suck at strategy!

National STRATEGY



A National Marine Research Plan for South Africa, 2014+

Prepared for

The National Research Foundation

By

P.H. Skelton[1]

March 2014

Plans informed by the pool….

Ecologist ≠ Physiologist

Word	No Repeats
climate	36

STRATEGY

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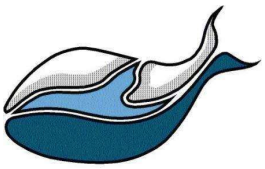
March 2014



Plans informed by the pool….

Ecologist ≠ Physiologist

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climate	36
genetic*	12

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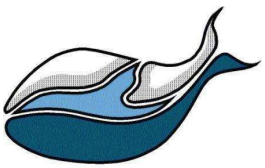

Plans informed by the pool….

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climate	36
genetic*	12
behaviour*	3

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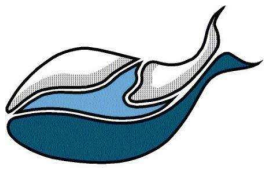

Plans informed by the pool….

Ecologist ≠ Physiologist

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climate	36
genetic*	12
behaviour*	3
physiolog*	1

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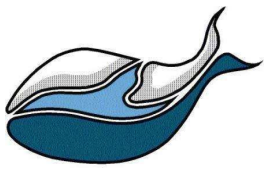


Plans informed by the pool….

Ecologist ≠ Physiologist

Word	No Repeats
climate	36
genetic*	12
behaviour*	3
physiolog*	1
model*	41

There are challenges……

BENEFIT

BCLME
Benguela Current Large Marine Ecosystem Programme

Funding period 1997 - 2008

gtz

Focus:

Common science

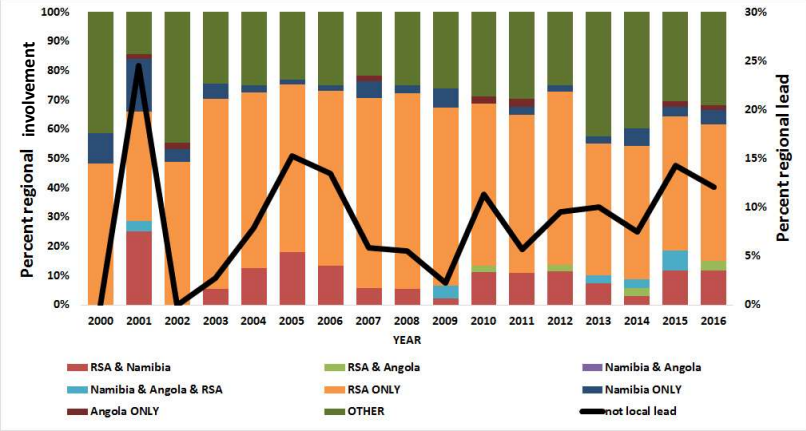
Capacity development

Norad

THE WORLD BANK

Collaboration within the BCLME (2000-2016)

➢800 papers: 70% regional authorship: 52% regionally led: 12% intraregional collaboration



Percent participation in peer-reviewed journal publications on the resources and/or environment of the BCLME region over the period 2000-2016 by regional country in isolation, or collaboration. Also shown are the relative contributions by papers on same that did not include a regional collaborator. Line shows percent regionally led publications.

Country	No papers	No papers led	No single country papers
Angola	24	2	0
France	115	65	14
Germany	170	129	75
Namibia	128	42	9
Norway	71	30	5
RSA	526	376	225
UK	89	40	12
USA	93	47	26

Number of papers on the resources and/or environment of the BCLME region published over the period 2000-2016 that included authors from the identified countries

- **40 non regional countries involved:**
- **Germany, France, USA and UK > 10% outputs, each**

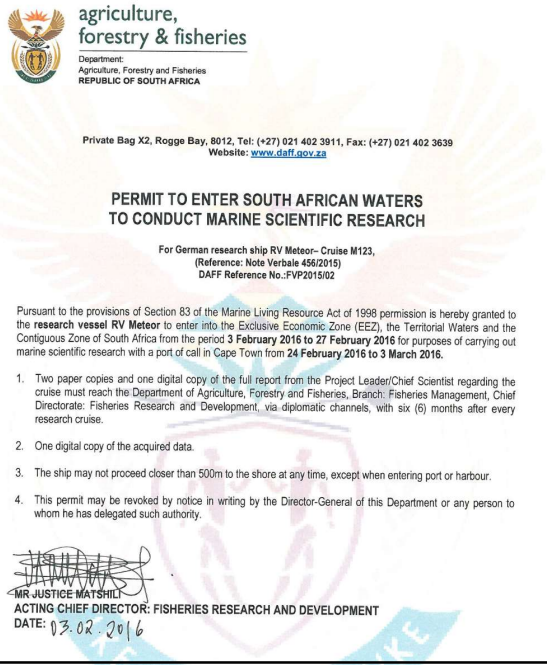
Number of papers on the resources and/or environment of the BCLME region published over the period 2000-2016 that included authors from the identified countries, expressed as a percentage of all collaborative papers published by scientists from those countries. Thus, 16.7% of all papers co-authored by South African scientists included Namibians, whilst 68,8% of all papers that included Namibian scientists also included South Africans. The in-country papers are expressed as a percentage of all papers co-authored by that country.

		Percent Collaboration							
		Angola	Namibia	RSA	France	Germany	Norway	UK	USA
Country	Angola	0.0	45.8	66.7	12.5	0.0	29.2	16.7	4.2
	Namibia	9.4	7.0	**68.8**	8.6	10.9	25.0	10.9	7.0
	RSA	3.0	**16.7**	42.8	15.0	7.4	8.9	10.5	7.2
	France	2.6	9.6	68.7	12.2	10.4	7.0	13.0	7.0
	Germany	0.0	8.2	22.9	7.1	44.1	5.3	4.1	10.0
	Norway	11.3	45.1	66.2	11.3	12.7	7.0	18.3	5.6
	UK	4.5	15.7	61.8	16.9	7.9	14.6	13.5	7.9
	USA	1.1	9.7	40.9	8.6	18.3	4.3	7.5	28.0

Why does international research in the BCLME NOT result in collaboration with regional scientists?

Collaboration and/or training is NOT a pre-requisite..

though training may be conducted (appropriate?)



agriculture, forestry & fisheries

Department: Agriculture, Forestry and Fisheries
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PERMIT TO ENTER SOUTH AFRICAN WATERS
TO CONDUCT MARINE SCIENTIFIC RESEARCH

For German research ship RV Meteor– Cruise M123,
(Reference: Note Verbale 456/2015)
DAFF Reference No.:FVP2015/02

Pursuant to the provisions of Section 83 of the Marine Living Resource Act of 1998 permission is hereby granted to the **research vessel RV Meteor** to enter into the Exclusive Economic Zone (EEZ), the Territorial Waters and the Contiguous Zone of South Africa from the period **3 February 2016 to 27 February 2016** for purposes of carrying out marine scientific research with a port of call in Cape Town from **24 February 2016 to 3 March 2016.**

1. Two paper copies and one digital copy of the full report from the Project Leader/Chief Scientist regarding the cruise must reach the Department of Agriculture, Forestry and Fisheries, Branch: Fisheries Management, Chief Directorate: Fisheries Research and Development, via diplomatic channels, with six (6) months after every research cruise.
2. One digital copy of the acquired data.
3. The ship may not proceed closer than 500m to the shore at any time, except when entering port or harbour.
4. This permit may be revoked by notice in writing by the Director-General of this Department or any person to whom he has delegated such authority.

MR JUSTICE MATSHILI
ACTING CHIEF DIRECTOR: FISHERIES RESEARCH AND DEVELOPMENT
DATE: 03.02.2016

IP

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- **Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND**
- **Drafting the work or revising it critically for important intellectual content; AND**
- **Final approval of the version to be published; AND**
- **Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.**

UPSHOT – builds resentment amongst local scientists and threatens future collaboration

Solutions:

Collaboration is vital – knowledge generation
Development of local skills base is vital
Skills must be relevant and deployable
Plan inclusively - early
"SOFT skills" development is as important: if not more important….

DO NOT EXPECT instant results – mentorship and follow-up

THANK YOU