

**Agulhas and Somali Currents Large Marine
Ecosystems Project**

Capacity Building and Training Component

National Training Plan for

SOUTH AFRICA

COMPILED

BY

SOUTH AFRICAN MARINE INSTITUTE (S.A.M.I.)

MAY 2011

EXECUTIVE SUMMARY

This project is part of a multi-agency Programme, the ASCLME (Agulhas and Somali Current Large Marine Ecosystems) whose intention is to institutionalize cooperative and adaptive management of Large Marine Ecosystems (LMEs). The Programme intends to review and summarize the current level of marine education and training in South Africa, which includes; Tertiary institutions, Private organizations, Governmental bodies, NGO's and others. The South African Qualification Authority Act of 1995 defines an education and training provider as:

“A body which delivers learning programmes which culminate in specified National Qualification Framework (NQF) standards and/or qualifications, and manages the assessment thereof”.

The Programme plans to illustrate herein a phased approach that progressively builds the knowledge base and strengthens technical and management capabilities at the regional scale to address trans-boundary environmental concerns within the LMEs. The approach also builds political will to undertake threat abatement activities and leverages finances proportionate to management needs. The Programme includes two parallel projects, one that addresses land-based sources of pollution (WIO-LaB, implemented by UNEP); and one that builds knowledge for the purposes of managing industrial fisheries (SWIOFP, implemented by the World Bank). An integral component of the project involves training and capacity building. This document provides a foundation for the training components of the ASCLME programme by providing synthesis of the national training requirements of SOUTH AFRICA.

CONTENTS

1. Introduction.....	- 6 -
2. Overall objectives and general principles of the ASCLME Training Programme - will be completed by Warwick.....	- 7 -
3. Inventory of current educational capacity in South Africa	- 8 -
3.1 General capacity, funding and infrastructure	- 8 -
3.2 Evaluation of training activities, including short courses, ongoing mentorship, training of trainers, language issues, availability and selection of trainees.	- 13 -
3.2.1 EVALUATION OF TRAINING AT UNIVERSITIES	- 13 -
3.2.1.1. University of Cape Town (UCT)	- 13 -
3.2.1.2. University of the Western Cape (UWC)	- 15 -
3.2.1.3. Rhodes University (RU).....	- 16 -
3.2.1.4. Nelson Mandela Metropolitan University (NMMU)	- 17 -
3.2.1.5. University of Witwatersrand (Wits).....	- 18 -
3.2.1.6. University of Pretoria (UP).....	- 20 -
3.2.1.7. Stellenbosch University (SUN).....	- 20 -
3.2.1.8. Cape Peninsula University of Technology (CPUT).....	- 22 -
3.2.1.9. University of KwaZuluNatal (UKZN).....	- 22 -
3.2.1.10. University of South Africa (UNISA).....	- 23 -
3.2.1.11 North-West University (NWU).....	- 23 -
3.2.2 EVALUATION OF TECHNICAL TRAINING FACILITIES – (including government training programmes)	- 24 -
3.2.2.1. Cape Peninsula University of Technology (CPUT).....	- 25 -
3.2.2.2. Marine and Coastal Management (MCM) - Cape Town	- 25 -
3.2.2.3. CAPE Action Plan for the Environment (CAPE)	- 26 -
3.2.2.4. Agulhas Somali Currents LMEs (ASCLMEs) & South West Indian Ocean Fisheries Project (SWIOFP).....	- 26 -
3.2.2.5. Ocean Data and Information Network for Africa (ODINAFRICA).....	- 26 -
3.2.2.6. Global Biodiversity Information Facility (GBIF).....	- 27 -

3.2.2.7. Global Ocean Observing System (GOOS).....	- 27 -
3.2.2.8. SysTEM for Analysis, Research and Training (START).....	- 40 -
3.2.2.9. Oceans Research	- 27 -
3.2.2.10. Anchor Environmental.....	- 28 -
3.2.2.11. Global Ballast Water Management Programme (GloBallast) in conjunction with the National Ports Authority South Africa.....	- 28 -
3.2.2.12. African Coelacanth Ecosystem Programme (ACEP).....	- 29 -
3.2.2.13. CapFish	- 29 -
3.2.3 EVALUATION OF RESEARCH INSTITUTIONS.....	- 30 -
3.2.3.1. MA-RE Institute UCT.....	- 30 -
3.2.3.2. Institute of Marine Environmental Law	- 31 -
3.2.3.3. The Environmental Evaluation Unit (EEU).....	- 31 -
3.2.3.4. PLAAS.....	- 31 -
3.2.3.5. Fishing Industry Research Institute (FIRI), Cape Town.....	- 32 -
3.2.3.6. Institute of Maritime Technology (IMT)	- 32 -
3.2.3.7. South African Marine Institute	- 32 -
3.2.3.8. South African Institute for Aquatic Biodiversity (SAIAB)	- 33 -
3.2.3.9. South African Environmental Observation Network (SAEON).....	- 33 -
3.2.3.10. Aquaculture Institute of South Africa (AISA)	- 34 -
3.2.3.11. Oceanographic Research Institute (ORI)	- 34 -
3.2.3.12. Integrated Marine Biogeochemistry and Ecosystem Research (IMBER).....	- 35 -
3.2.3.13. Addressing Land-based Activities in the Western Indian Ocean (WIO-Lab).....	- 35 -
3.2.3.14. Council for Scientific and Industrial Research (CSIR).....	- 35 -
3.2.3.15. Bayworld.....	- 36 -
3.2.4 REGIONAL AND INTERNATIONAL NGO'S (including industry) - Programmes with TCB components.....	- 36 -
3.2.4.1. Scientific Committee for Oceanographic Research (SCOR).....	- 36 -
3.2.4.2. International Council for Science (ICSU).....	- 36 -
3.2.4.3. Food and Agriculture Organization (FAO).....	- 37 -
3.2.4.4. Western Indian Ocean Marine Science Association (WIOMSA).....	- 37 -
3.2.4.5. Council for Geosciences (CGS).....	- 37 -
3.2.4.6. WWF.....	- 38 -

3.2.4.7. African Centre for Climate and Earth Stewardship Science (ACCESS)	- 40 -
3.3 Other.....	- 41 -
3.3.1 SANCOR	- 41 -
3.3.2. Southern African Institute for Environmental Assessment (SAIEA)	- 42 -
3.3.3. International Ocean Institute (International) & IOI-SA.....	- 42 -
3.3.4. TRAIN-SEA-COAST (TSC).....	- 43 -
4. National needs and capacity for meeting them	- 45 -
4.1. Technical training	- 45 -
4.2. Economics and socioeconomics.....	- 45 -
4.3. Numerical expertise (statistics, applied mathematics etc)	- 45 -
4.4. Data management and information management skills	- 46 -
4.5. Legal expertise	- 46 -
4.6. Language education	- 47 -
4.7. Governance	- 47 -
4.8. Fisheries science	- 47 -
4.9. Oceanography (Physical, chemical, biological).....	- 47 -
4.10. Coastal zone management including expertise in GIS and MPA's	- 47 -
4.11. Geology and Geomorphology including mineral extraction.....	- 50 -
4.12. Aquaculture.....	- 50 -
4.13. Climate research.....	- 50 -
4.14. Environmental Education, human health	- 50 -
4.15. Tourism	- 50 -
4.16. Training of inspectors and observers, community involvement? (MCS, including pollution etc)	- 51 -
4.17. Trans-disciplinary training for managers including ecosystem approach.....	- 52 -
4.18. Biodiversity, Taxonomy and EIA Training	- 52 -
4.19. Pollution: land and marine based.....	- 53 -
5. Regional and International linkages and support.....	- 61 -
6. Proposed start-up training projects and activities	- 64 -
7. Acknowledgements.....	- 76 -
8. Bibliography	- 77 -

APPENDIX 1.....	- 79 -
APPENDIX 2.....	- 81 -
APPENDIX 3.....	- 83 -
APPENDIX 4.....	- 85 -

1. Introduction

The purpose of the ASCLME Project is to institutionalize cooperative and adaptive management of Large Marine Ecosystems (LME's). A phased approach is planned that

1. Progressively builds the knowledge base and strengthens technical and management capabilities at the regional scale to address trans-boundary environmental concerns within the LME's,
2. Builds political will to undertake threat abatement activities and,
3. Leverages finances proportionate to management needs.

In addition to the ASCLME Project, the Programme includes two parallel projects, one that addresses land-based sources of pollution (WIO-LaB, implemented by UNEP); and one that builds knowledge for the purposes of managing industrial fisheries (SWIOFP, implemented by the World Bank).

The activities within the ASCLME Project are focused on filling the significant coastal and offshore data and information gaps for these LME's by capturing essential information relating to the dynamic ocean-atmosphere interface and other interactions that define the LME's, along with critical data on artisanal fisheries, larval transport and nursery areas along the coast. The overall objective of this data capture will be to deliver national Marine Ecosystem Diagnostic Analyses (MEDA's) that feed into a Trans-boundary Diagnostic Analysis (TDA's), and Strategic Action Programmes (SAP).

Overall objectives and general principles of the ASCLME Training Programme -

The Agulhas and Somali Current Large Marine Ecosystems (ASCLME) project is a venture that will see the nine countries of the western Indian Ocean region, including Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Somalia, South Africa and Tanzania working together to strive toward a common goal. This common goal is based on the premise that all nine countries are serious about caring for the marine environment and is determined to use resources to achieve solutions common to the western Indian Ocean.

A key output of the programme is that of capacity building and training (CB&T) in relation to the long-term LME monitoring and management process are achieved. There is a need to identify institutional, programme and human capacity building requirements and for these to be addressed through training initiatives. A CB&T specialist (consultant) is required to undertake a review of national and regional training and capacity building initiatives, identify key gaps, and assist the national CB&T coordinator in producing a draft, comprehensive regional work programme.

The objectives of the Agulhas and Somali Current Large Marine Ecosystems (ASCLME) Project are:

- To gather new and important information about ocean currents and how they interact with and influence the climate, biodiversity and economies of the western Indian Ocean region;
- To document the environmental threats that are faced by the countries of the region in a Trans-boundary Diagnostic Analysis (TDA);
- To develop a Strategic Action Programme (SAP) which sets out a strategy for the countries to collectively deal with trans-boundary threats;
- To strengthen scientific and management expertise, with a view to introducing an ecosystem approach to managing the living marine resources of the western Indian Ocean region.

3. Inventory of current educational capacity

3.1 General capacity, funding and infrastructure

General capacity and infrastructure

The Bill of Rights, contained in the South African Constitution, 1996, stipulates that everyone has the right to a basic education, including adult basic education and further education, which the State, through reasonable measures, must progressively make available and accessible to all South Africans. Formal education in South Africa is categorized according to three levels – General Education and Training (GET), Further Education and Training (FET) and Higher Education (HE).

The GET band consists of the Reception Year (Grade R) and learners to Grade 9, as well as an equivalent Adult Basic Education and Training (ABET) qualification. The FET band consists of grades 10 to 12 in schools and all education and training from the National Qualifications Framework (NQF) levels 2 to 4 (equivalent to grades 10 to 12 in schools). The HE band consists of a range of degrees, diplomas and certificates up to and including postdoctoral degrees. These education levels are levels 5 (Certificate at level 5 to PhD's at level 10). See Table 1.

Table 1. The South African National Qualifications Framework (NQF).

Band	NQF Level	Types of Qualifications and Certificates	Locations of Learning for Units and Qualifications
Higher Education and Training Certificate – HET			
Higher Education and Training (HET)	10	◆ Doctoral Degree (PhD)	Tertiary/Research/Professional Institutions
	9	◆ Masters Degree	
	8	◆ Honours ◆ Post-Graduate Diploma	
	7	◆ Degree ◆ Advanced Diploma	Universities, Universities of Technology, Colleges, Workplace, Private/ Professional Institutions
	6	◆ Diploma ◆ Advanced Certificate	
	5	◆ Higher Certificate	

Further Education and Training Certificate – FET				
Further Education and Training	4	School / College / Trade Certificates / Learnerships Mix of units from all	State/Private High Schools, Technical Schools and Colleges, Private Colleges, Nursing/Military/Police Training Centres, Industry Training Boards, RDP/Labour Market Schemes, Unions, Workplaces	
	3			
	2			
General Education and Training Certificate – GET				
General Education and Training	1	Senior Phase	ABET level 4	Formal Urban/Rural/Farm/Special Schools, occupational/work-based training, RDP/Labour Market Schemes, NGO's – churches, night schools, ABET programmes, private providers, Industry Training Boards, Unions, Workplaces, upliftment/community programmes,
		Intermediate Phase	ABET level 3	
		Foundation Phase	ABET level 2	
		Pre-school	ABET level 1	

The Higher Education Act (2007) provides a framework for the higher education system as depicted in Table 1.

Qualification types

The framework has nine qualification types mapped onto the six levels of the NQF occupied by higher education qualifications. Some levels have more than one qualification type. The higher education framework therefore comprises the following qualification types:

- ***Undergraduate***
 - Higher Certificate
 - Advanced Certificate
 - Diploma
 - Advanced Diploma
 - Bachelor's Degree
- ***Postgraduate***
 - Postgraduate Diploma
 - Bachelor Honors Degree
 - Masters Degree
 - Doctoral Degree

The nine qualification types and their designated variants are expected to accommodate present requirements but the list is not immutable.

The Minister, on the advice of the Council for Higher Education (CHE), may approve a new qualification type and its unique descriptor when a proven need arises as a result of developments in knowledge production or acknowledged international practice. The use of qualification types is regulated by this policy. A qualification type may only be used if the qualification fulfills the specifications for the type.

According to the Act, the higher education qualifications framework (HEQF) is designed to:

- a. Be sufficiently flexible to accommodate different types of higher education institutions and enable institutions to pursue their own curriculum goals with creativity and innovation;
- b. Facilitate the education of graduates who will contribute to the social, cultural and economic development of South Africa and participate successfully in the global economy and knowledge society;
- c. Enhance the development of a vibrant, high quality research system;
- d. Be compatible with international qualifications frameworks in order to ensure international recognition and comparability of standards;
- e. Be suitably flexible to accommodate the development of new qualification types and specializations as the need arises;
- f. Be simple, clear, easy to understand and user-friendly for the higher education system and its clients;
- g. Facilitate qualification articulation across the higher education system and assist students to identify potential progression routes, particularly in the context of lifelong learning; and
- h. Articulate with the rest of the NQF.

Then the Act further describes the scope and application of the higher education system by stating that the HEQF applies to all higher education institutions, both public and private. The HEQF regulates and specifies all higher education qualification types, including qualifications based on unit standards, in the higher education system and their designators and qualifiers, and the manner in which the qualifications are designed and relate to one another. It does not deal with nor does it prejudice the design and registration of unit standards to meet specific learning outcomes.

The NQF levels (Table 1) are integrated within the NQF provided by the South African Qualifications Authority (SAQA) Act, 1995 (Act 58 of 1995). By mid-2007, the South African public-education system had 12, 3 million learners, 387 000 educators, 26 592 schools, 2 278 Abet centres, 50 public FET institutions, 4 800 Early Childhood Development (ECD) centres and 23 HE institutions. Of the 26 592 schools, 1 000 were independent, 400 were special-needs schools and the remainder were ordinary schools. Of all schools, 6 000 were secondary and the rest primary. The South African government has committed R3.6 billion (US\$500 million) to universities to reverse a funding decline (Burger, 2009) reward institutions that produce more graduates, improve infrastructure and relieve financial pressure to raise fees. The financial outlook for South African universities has begun to improve after decades of real-term declines in state subsidies. The government has acknowledged that under-funding, along with rapidly growing student numbers, have placed severe strains on higher education quality and infrastructure, and that universities have a crucial role in filling skills gaps that are stunting economic growth (Burger, 2009).

The financial planning process by government was under the ambit of the Department of Education (R3.6 billion) and since 2008 a significant amount of this had been allocated to institutions to increase enrolment and graduate outputs in engineering and science. Universities currently produce approximately 1,500 engineering graduates annually from four-year bachelor and Bachelor of Science degrees – but many more are needed in this critically skills-short field. The South African government has already allocated R48 million in total to four leading universities – Cape Town, Wits, KwaZulu-Natal and Pretoria – based on their graduation success rates, especially intended for

previously disadvantaged learners. Major hindrances to improving education levels are fees for higher education. This has resulted in majority poorer students from high school not being able to advance to the higher education sector every year either because they have been excluded by universities for not paying outstanding fees or because of financial difficulties incurred by the costs of higher education costs. The National Student Financial Aid Scheme cannot afford to fund all poor students, or even the full costs of those it can fund (Science and Technology Yearbook, 2009/10).

Funding and partnerships in education system of South Africa

South Africa has a very high standard of higher education capacity and infrastructure. Currently, 23 Universities are soundly established as leading tertiary institutions, some of international standing. The problem therefore is not the higher education sector, but rather the informal sector. There is no national framework, which governs the sector and currently functions on an ad hoc basis apart from the various SETAS'.

Central to the education policy framework is the contention that a high-quality education sector cannot be built by government alone. It depends on creative and dynamic partnerships between the public sector, civil society and international partners. The Department of Education, educator unions, the South African Council for Educators(SACE), Education Labour Relations Council (ELRC) and the ETDP Seta work together to achieve education transformation goals. The success of key national initiatives (including South African Literacy Initiative [SANLI]) relies largely on partnerships with the private sector and NGOs. Several partnerships have been consolidated, providing working models of educational transformation through public-private partnerships. The Business Trust, a partnership between business and government, works in education through three NGOs, namely the Read Educational Trust, the JET Education Services and the National Business Initiative Colleges Collaboration.

Funding

The South African government is responsible for education in the country and spends approximately 20 % of the national budget on education. For the 2010/2011 Budget, Minister Pravin Gorden, in his budget speech said the following:

- "..., education spending remains our largest item of spending; giving meaning to our commitment that it is our number one priority. The total budget for education next year is R165 billion.
- To roll out workbooks in all 11 official languages to help raise our literacy and numeracy levels and to test all learners in grades 3, 6 and 9, a further R2.7 billion is allocated to the Department of Basic Education.
- Expanding and improving capacity at our FET colleges is a vital part of our growth strategy. We have set ourselves ambitious targets to expand the number of young people studying vocational subjects. The budget for FET colleges of R12 billion over three years, has been shifted from provinces to the national department. A further R1.3 billion is allocated to improve the salaries of FET college educators."

It is therefore evident that the South African government acknowledges the importance of improving education. However, despite the education sector receiving the highest levels of investments, the investments arguably have the lowest return on investment. Compared with most other countries, education gets a really big slice of the pie (20% of total government expenditure). In the 2006 Budget education received R92.1-billion, amounting to 17.8% of total spending. For the 2010/2011 Budget it is 18.1%. It has been argued that the reason for the high education costs was to address the huge backlogs left by 40 years of apartheid education. Under that system, white South African children received quality schooling virtually for free, while their black counterparts had only "Bantu education".

Although today's government is working to rectify the imbalances in education, the apartheid legacy remains. The greatest challenges lie in the poorer, rural provinces like the Eastern Cape and KwaZulu-Natal. Schools are generally better resourced in the more affluent provinces such as Gauteng and the Western Cape. Illiteracy rates are high at around 24% of adults over 15 years old (6- to 8-million adults are not functionally literate), teachers in township schools are poorly trained, and the matric pass rate remains low. While 65% of whites over 20 years old and 40% of Indians have a high school or higher qualification, this figure is only 14% among Blacks and 17% among the Coloured population.

The government is in particular targeting education for the poorest of the poor, (Burger 2009) (www.southafrica.info/about/education/education.htm).

National Research Foundation (NRF)

The NRF was established through the National Research Foundation Act (Act No 23 of 1998), following a system-wide review conducted for the Department of Arts, Culture, Science and Technology (DACST). The new entity incorporated the functions of the research funding agencies that were previously servicing various sections of the research community, namely the former Centre for Science Development (CSD) of the Human Sciences Research Council (HSRC) and the former Foundation for Research Development (FRD) that included several National Research Facilities.

As an independent government agency, the NRF promotes and supports research in all fields of knowledge. It also conducts research and provides access to National Research Facilities. The NRF provides services to the research community especially at Higher Education Institutions (HEIs) and Science Councils with a view to promote high-level human capital development. The NRF aims to uphold excellence in all its investments in knowledge, people and infrastructure.

The NRF is a key public entity responsible for promoting and supporting the development of HR for research, technology and innovation in all fields of Science and Technology. The NRF carries out its responsibilities by ties such as South African Agency for Science and Technology Advancement (SAASTA) and co-operative agreements with individual researchers, research groups and institutions locally, regionally and internationally (through the Research and Innovation Support Agency [RISA]) services to the research community.

The NRF focuses on contributing to government's strategy to create wealth and improve the quality of life of all citizens. Doctoral graduates are the platform upon which social and technical progress, innovation and business performance can flourish. The key driver for all the NRF's activities is the production of large numbers of highly skilled people who can generate new knowledge, develop and use new technologies and innovate and drive the competitiveness of the country in international world markets. The NRF regards HR development as a long-term investment in growing the pool of resources by drawing in learners who will become scientists and innovators.

The NRF consists of three divisions:

- Research and Innovation, Support and Advancement (RISA) which constitutes the research support and promotion agency of the NRF; and
- The South African Agency for Science and Technology Advancement (SAASTA) which provides and manages cross cutting activities that advances science and technology into various communities in South Africa.
- The National Research Facilities that undertake research in specific research fields. Through a series of integrated programmes, Saasta is developing an infrastructure that supports high impact activities and science-promotion sites.

Table 2. Overview of investments made by the NRF 2008-2009.

(Source: NRF Annual Report: 2008-2009)

Investment in research equipment	R	92,300,000
Investment in research infrastructure	R	36,500,000
Grants to researchers	R	321,000,000

The NRF therefore drives funding in the formal higher education sector and is arguably the main funder thereof (see Table 2).

There is a growing need to source funding from the private sector as government support for capacity building and training in the higher education sector is diminishing.

3.2 Evaluation of training activities, including short courses, on going mentorship, training of trainers, language issues, availability and selection of trainees.

3.2.1 EVALUATION OF TRAINING AT UNIVERSITIES

Listed below are Universities within South Africa, which offers marine related qualifications (undergraduate and post-graduate). Within each University, the Faculty of Science and which Departments offer such degrees are briefly explained. Although other Faculties and Departments such as Law and Economics etc. have ties and projects to the marine sector, they are not explained in detail. Readers are encouraged to refer to the website for more information about each University. See Appendix 1 for a list of websites and contact numbers.

3.2.1.1. University of Cape Town (UCT)

UCT has an international reputation for being an institute for learning with very high standards. As such, it attracts numerous students from across the world. It has several departments and research institutes (and centres of excellence) that can play a key role in marine training and capacity building in the region. In terms of Marine Science education UCT have the following Departments:

- *Environmental and Geographical Science*

Environmental and Geographical Science at UCT is characterised by an integrated approach to the study of human-environment relations. The discipline requires the practitioner to draw on a range of knowledge and skills associated with the natural and social sciences. The student is offered sound theoretical and practical training in the study of environmental and geographical sciences. The department is committed to the development of knowledge, understanding, and management of the interactions between humans and their social, biological, and physical life-support systems, and to the recognition of the values conducive to the sustained operation of these systems.

The department also has a large interdisciplinary research involvement. Some of the focus areas include climatology, climate-change issues, quaternary environments, soil erosion and land degradation, environmental management, urban issues, disaster risk management, third-world-development issues, GIS (Geographical Information Systems), and remote sensing. Training in the field of environmental and geographical science may lead to career opportunities in fields such as environmental management, cartography, research, education, community development and tourism.

- *Geological Sciences*

The department of Geological Sciences offers an undergraduate curriculum in the Geological Sciences (3 year major) including an honours programme (4th year). At the postgraduate level the department offers a Master of Science (by thesis) as well as a full PhD programme. Research is conducted in a wide range of sub-disciplines and the department has strengths in geochemistry, mantle petrology, igneous and metamorphic petrology, Precambrian studies, marine geosciences, environmental geochemistry, and structural and economic geology.

The department has a wide range of analytical facilities. The efficient production of high-quality abundance data for major and trace elements, ionic species, radiogenic and stable isotopes, and mineral proportions is fundamental to many of its research endeavours. Apart from installation and maintenance activities, staff members also conduct developmental research to establish and refine analytical techniques.

- *Mathematics and Applied Mathematics*

The Department of Mathematics and Applied Mathematics is one of the largest departments at the University of Cape Town. The department covers a broad range of activities and strives to combine excellence with equity. The department balances research into conceptually deep topics, such as categorical topology, with active and large-scale contract work in real-life topics, such as marine resource assessment. The department's research ethos is recognised nationally through the support of South Africa's National Research Foundation, and attracts students and research visitors from around the world. Apart from having a large postgraduate school in the department, they also offer a course in Effective Numeracy to students without matric mathematics. The department is involved in outreach activities and produces the Mathematical Digest, which is sent out quarterly to over 2 000 schools countrywide as well as a Math competition, the largest of its kind.

- *Molecular and Cell Biology*

The Department teaches Biochemistry, Genetics and Microbiology (which includes Biotechnology) major courses in the Chemical and Molecular Sciences Programme at second and third year level, and offers the following postgraduate degrees in Molecular and Cell Biology: BSc (Hons), MSc and PhD. An MSc in Bioinformatics is offered in conjunction with the National Bioinformatics Node at UCT. The department has interests and expertise in diverse areas of biology. The members of staff are involved in research that is of great economic and social importance to South Africa and the rest of Africa. The research includes areas such as health and disease, plant and animal pathogens, viruses, genetic engineering, new crops, and agriculture. At undergraduate level the department offers a degree programme in chemical, molecular, and cellular sciences with various areas of specialisation.

- *Oceanography*

The Department of Oceanography is the only one in South Africa, and offers an undergraduate BSc with a specialisation in Ocean and Atmosphere Science. The department has a major focus for teaching and research in physical oceanography, atmospheric science, and ocean climatology in South Africa and elsewhere in Africa. Research is carried out across a broad range of topics, with a number of groups such as coastal upwelling, ocean climatology, satellite remote sensing and ocean modelling. Strong collaboration exists between several international research groups and the department of which included the IRD in France. The department has strength in ocean modelling. The Oceanography department hosts the MRSU (Marine Remote Sensing Unit) which provides a platform for research and the production of operational oceanographic remote sensing products for the entire southern African coastal region.

The aim of the department is to advance knowledge of all facets of the ocean environment, and to use this knowledge for the benefit of people everywhere. Although the emphasis is on the physical

environment in the oceans and atmosphere around southern Africa, the intention is to use this new knowledge to draw conclusions that are regionally and globally relevant.

- *Statistical sciences*

The Department of Statistical Sciences at the UCT is responsible within the University for the development of the Statistical Sciences such as Biostatistics, Biometrics, Econometrics, Technometrics, Operations Research, Management Science, Quantitative Methods, Decision Science and Quality Management, and for the application of the Statistical Sciences in all areas of human endeavour. The department is located in both the Faculty of Commerce and the Faculty of Science. In the Faculty of Science it forms part of the School of Mathematical Sciences, along with the mathematics and applied mathematics department and the computer science department.

In its teaching, the department recognises that there are needs both to train professionals in the statistical sciences and to provide quantitative and decision-making skills to students in other disciplines. In its research, the department seeks to maintain a balance between the development of theory and applications of that theory, and a balance between research of a general nature (such as outliers in regression analysis) and research with a specifically African context (such as national water-resources planning and the study of migratory patterns of the African penguin).

- *Zoology*

The Zoology Department incorporates the Marine Biology Research Centre (MBRC), the Percy FitzPatrick Institute of African Ornithology (PFIAO) - a DST/NRF Centre of Excellence, the Freshwater Research Unit (FRU), the Animal Demography Unit (ADU), and groups involved in physiological, biochemical, ecological, evolutionary and ethological research. It has the largest postgraduate school, and is the most productive department in terms of publication output, in the University. The department offers a wide variety of courses dealing with fundamental questions of how organisms function (behaviour/physiology); the origins and diversity of species (evolution); and the ways in which species, populations, and communities interact (ecology). Senior courses focus on functional aspects of animal life and on the management and conservation of single species and entire ecosystems. The research from the department in the areas of marine and freshwater ecology, ornithology, mammalian biology, conservation biology, entomology, and palaeontology are recognised both nationally and internationally.

- *Fisheries Economics*

Course Description

This course aims to provide the student with a good theoretical background in bioeconomic principles which could be used in practical management tasks. The course aims also to integrate biological knowledge on population dynamics with economic reasoning.

The interplay between vessels/fishermen and fish stocks is studied for the case of an open access fishery and for different management regimes. Bioeconomic theory is used in the analysis of selected fisheries, both nationally controlled and those in which two or more countries are involved. Practical issues related to the use of available data for establishing bioeconomic reference points are addressed.

3.2.1.2. University of the Western Cape (UWC)

The Faculty of Natural Sciences at UWC have the following Departments to promote Marine Science education:

- *Biodiversity and Conservation Biology Department*

The department was formed as a merger of the former Botany and Zoology departments. The Department has a strong focus on marine biology (botany and zoology) and marine ecology (including biological oceanography and environmental monitoring). The Departments' strength lies in taxonomy and systematics, ecology and physiology.

- *Department of Statistics*

On an Under-Graduate level the department offers Statistics from first-year to third-year level. Students who have completed an introductory statistics module can continue with the Statistical Demography module at third-year level, which opens the option to continue with postgraduate studies in Population Studies. In order to qualify for Statistics at Post-Graduate level students have to complete at least second-year mathematics.

- *Department of Mathematics*

The Department offers courses for the degrees, B.Sc. (Hons), M.Sc. and Ph.D. The Department have an established program of fundamental research in mathematics, and also produce research in other areas such as Financial Mathematics, Mathematics Education, Topology, Coding and Mathematical Modelling,

UWC established a Research Institute in 1995 under the School of Government, in the Economic and Management Sciences Faculty called PLAAS: Institute for Poverty, Land and Agrarian Studies. Their expertise is in fisheries management and aspects of community fisheries (see section 3.2.3.4).

3.2.1.3. Rhodes University (RU)

In the Faculty of Science at Rhodes University, the following Departments offer degree (undergraduate and postgraduate) courses related to Marine Science:

- *Department of Earth and Environmental Science*

Environmental Science, the study of the relationship between humans and their environment, takes a multi-disciplinary approach to sustainable environmental management and seeks to attract students from a range of academic disciplines. The Department is relatively young, and was established in 1998. By 2002 it grew to a full department and from 2004 until 2007, the department was also responsible for the development and coordination of the environmental management electives for the Rhodes MBA programme. Rhodes Investec Business School now run short courses and MBA programs.

- *Department of Geography*

An important part of this Department is the GIS, Map work and computing facility. Postgraduates use the facility for general computing purposes like word-processing of, and analysis work for, projects, essays and theses. A major use for the facility is GIS (Geographical Information System) training and research. The work ranges from basic digitising of paper maps to sophisticated satellite image analysis and distribution analyses of virtually any data one can think of from distribution of crime and sales of eggs at different stores to locating release sites for captive bred wildlife.

- *Department of Ichthyology and Fisheries Science*

The Department of Ichthyology and Fisheries Science (DIFS) is a leading African academic institution supporting the sustainable utilisation and study of fish and fisheries through teaching and training of students, conducting research and providing service support. The DIFS was founded in

1981 when the former JLB Smith Institute of Ichthyology (now South African Institute of Aquatic Biodiversity - SAIAB), became a National Museum. It is the only department of its kind on the Southern Hemisphere. DIFS offers both undergraduate and postgraduate course in fisheries management that includes a component on aquaculture and have recently offered a Master in Science in Aquaculture. DIF also have a host of aquaculture related projects and has all the necessary facilities for marine and freshwater aquaculture research. Due to its close ties with SAIAB its primary focus is based on ichthyology. The institute can offer a host of fisheries related projects as well as offer expertise in fish taxonomy, feeding and reproductive biology and larval dynamics, stock assessment, and spatial analysis and geographic information systems (GIS).

- *Department of Zoology*

All Zoology students have to complete the first two years before specialising in either African Terrestrial Zoology or Marine Biology. Students complete two first year courses, Cell Biology and Animal Diversity, Structure and Function, and two second year courses, Principles of Ecology and Evolution and Environmental and Behavioural Physiology. Students, who choose Marine Biology in their third year, cover topics such as ocean circulation, primary production, ecology of the deep sea, rocky shores, sandy beaches and estuaries, planktonic food webs and pelagic/demersal fisheries, and the behavioural and physiological ecology of intertidal invertebrates. This course emphasises the physical properties of the marine environment and how these shape species' interactions and food webs.

Rhodes University has many experts who facilitate training and development in the region. Finally SAIAB is directly linked to both the ACEP and the SAEON programmes. Closely linked to the University but an independent consulting firm Enviro-Fish Africa (Pty) Ltd specializes in the fields of conservation of biodiversity, resource management and development, capacity building and marine surveys. Services are also related to the marine and inland environment with particular emphasis on fish, fisheries, parks, catchment conservation and tourism. The organization offers capacity development by way of specialist environmental education services, materials development and programme implementation, management capacity building, development projects, community capacity building, public participation in natural resource related projects, institution building, training of staff and development of educational materials (e.g. participatory resources and CD ROMs).

- ◆ *Southern Oceans Group*

The Southern Ocean Group is concerned with fundamental research on the biological oceanography of the Antarctic and sub-Antarctic realms.

The Southern Ocean Group is an extremely active and productive research group based at the Department of Zoology and Entomology. The group is involved in a five-year program on biological oceanography at the sub-Antarctic Prince Edward Islands in collaboration with a physical oceanographic research group at the University of Cape Town. The main thrust examines links between planktonic food production/availability and land-based predators (mostly seals and penguins) on the islands. This provides information on variability in the ecosystem to managers of the islands. A second thrust investigates the biology of krill in Antarctic waters. The group has strong collaborative links with Scandinavian and other European research groups.

3.2.1.4. Nelson Mandela Metropolitan University (NMMU)

NMMU's vision envisages being a world-class Science Faculty, advancing understanding of the world around them and helping to address the many needs of South Africa as well as the rest of Africa. According to this institution, education in the fields of Science and Technology remains a top priority in South Africa. The Faculty of Science is fully committed to meeting this challenge. With modern teaching and research programmes and excellent facilities, it is at the forefront in Agricultural, Biological, Earth, Mathematical and Physical Sciences. NMMU offers both an undergraduate (Diploma and Bachelor degrees) and postgraduate (Honours, MSc and PhD) qualification opportunity in the areas of estuaries and ecosystems of the coastal zone and hinterland and the processes driving them. The Zoology Department specializes in fields regarding research in coastal zones and resource management thereof.

While the government has stressed that South Africa needs more skilled scientists and technologists, many school-leavers are not sufficiently equipped to study in these fields. With this in mind, the University has introduced relevant Foundation programmes, which supply potential students with the necessary background and a solid foundation to enable them to be successful in the Faculty of Science. In addition, they offer Science Diploma and Degree programmes over four years. These Extended Curriculum programmes will enable students to obtain an excellent grounding in these important fields.

Research programmes in the Faculty addresses the challenges in these fields and ensures that dedicated scientists who are recognised nationally and internationally teach students. Many of their researchers have strong collaborative ties with top research groups at other international institutions, thus maintaining a high academic standard.

The activities in the Faculty of Sciences are grouped into three different Schools:

- School of Bio-molecular and Chemical Sciences
- School of Computer Science, Mathematics, Physics and Statistics
- School of Environmental Sciences

Integrated Environmental and Coastal Management (IECM) at NMMU

Rhodes University houses a unit, which provides services on all aspects of coastal zone environment. Founded in 1984, the IECM is a multi-disciplinary association of academic staff members and a small, full-time team of environmental consultants leads graduate students at the NMMU. The IECM team comprise of a diverse group of coastal scientists and senior students based at the University. Their members have experience of coastal management issues, and all have undertaken research in the coastal zone. Several members of the team are also leaders in their respective fields within South Africa and have published extensively. The Institute also works very close with the Department of Geosciences particularly with regard to coastal processes, marine, estuarine and coastal dune deposits, groundwater, marine and estuarine pollution and environmental impact assessments, utilizing tools such as GIS and remote sensing.

3.2.1.5. University of Witwatersrand (Wits)

In the School of Animal, Plant, Environmental Sciences, the Department of Zoology, houses the Physiology unit. The unit conducts research on phytoplankton (toxic and non-toxic species) ranging from identification, taxonomy, developmental and cell biology studies as well as ultra structural and phylogenetic studies. Zoology covers a very broad range of fields. Animal life is shaped by central processes of evolution, heredity and development, and ranges from ecological studies to those in the cell and molecular field. The syllabus is designed to provide broad competence in Zoology and covers these fields, but is flexible and allows for specialization in the third year. Two major degrees offered up to PhD level is:

1. Ecology, Environment and Conservation

Objectives

This career line provides students with insight to the quantitative study and use of ecological, physiological and systematic principles in the context of environmental science and its applications in conservation biology and environmental management.

2. Plant sciences

Objective

To expose students to the current range of plant science expertise in the school and to provide students with the appropriate skill, knowledge and attitudes which would allow them to enter a wide range of plant science and biological careers and to provide a foundation for future specialisation.

- **Environmental Law Programme at WITS**

Vision Statement

“Our vision is to become the premier environmental law programme in South Africa and the African continent more broadly through the quality of our under- and postgraduate teaching, supervision and research and our service to the environmental NGO community”.

- **Graduate Programs**

Undergraduate Programme

At an undergraduate level we offer an elective course on Environmental Law, as part of the Bachelor of Laws (LLB) programme.

Postgraduate Programme

Students who already hold an LLB qualification can enrol for a Master of Laws (LLM) in the field of environmental law. A candidate for the LLM in the field of Environmental Law must complete a research report in the field of environmental law. Students should also complete a compulsory course; Introduction to Environmental and Sustainable Development Law and an additional two courses must be chosen.

- **Short courses**

Short courses in the field of environmental law are offered under the auspices of the Mandela Institute. These take two forms:

Certificates that run co-extensively with LLM courses:

All LLM courses in the field of environmental law are simultaneously offered as certificate courses. Certificate students attend classes with LLM students in the evening over a period of one semester. Certificate students are assessed in the same way, provided that certificate students can choose whether to complete the assignment or the examination. A student who has successfully completed a certificate course can apply for this to be recognized as a credit toward the LLM at a later stage, provided that both forms of assessment (assignment and examination) have been completed. Students who are unable to complete the assessment receive a certificate of attendance.

Customised short courses:

These courses are offered from time to time as the need arises, or upon the request of a particular client. They run over a shorter period of time than the courses above (usually over a period of a week or a few days). In 2009, the Mandela Institute offered a course in Mining Law, which included a significant section on Mining and the Environment. A course on the Environmental Impact

Assessment in the Agricultural Sector was also developed for the agriculture branch of the Gauteng Department of Agriculture, Conservation and the Environment. It is not necessary for the students on these courses to be in possession of an LLB although a university qualification in another field is desirable.

3.2.1.6. University of Pretoria (UP)

The Faculty of Natural and Agricultural Science contribute substantially to the building of research and teaching capacity in South Africa. The Faculty produces highly-skilled graduates and generates new scientific knowledge through our research publications. The Faculty is managed according to a decentralized model and presents a variety of study programmes offered by the following four streams:

- Biological Sciences
- Agricultural and Food Sciences
- Physical Sciences
- Mathematical Sciences.

The Faculty rates among the best science faculties in the country. A significant number of our scientists are evaluated internationally and, as a result, are acknowledged by the National Research Foundation (NRF) as researchers of high international standing (and in some cases, as world leaders in their fields). This ensures that our postgraduate students participate in research teams that can compete with the best in the world.

Through the Department of Zoology and Entomology in the Faculty, conducts research on seals and as well has many projects that are being conducted on Marion Island. The University also has a marine mammal unit based at the South African National Museum in Cape Town that focuses on whales and dolphins and top predator interactions and roles within the ecosystem. The university's genetics department is also conducting stock separation studies on many fish and invertebrate species such as oysters.

3.2.1.7. Stellenbosch University (SUN)

The University of Stellenbosch have two important divisions that contribute to Marine Science education in South Africa.

1. Aquaculture
2. Coastal Engineering

The Aquaculture division at SUN fall under the Department of Natural Sciences, which was, established 1988. The division offers two semester courses with a curriculum comprising of aspects such as water quality, nutrition, physiology, production systems, management systems, disease management and processing. These courses form part of the undergraduate system with postgraduate option. Postgraduates can complete a MSc or PhD in animal physiology, animal sciences, food sciences, genetics, and zoology and nature conservation with an aquaculture focus. The aquaculture programme also offers practical training whilst undertaking these courses such as placement within the industry, hatchery management, and production management and processing and marketing. This molecular aquatic research group within the Department of Genetics at the University focuses on the study of levels of genetic diversity and patterns of gene flow of various aquaculture species including among others: abalone, eel and the African catfish. The information generated is applicable to

management strategies for the conservation of species and enhancement for breeding/commercial purposes by identifying the representatives of individual stocks.

1. Aquaculture

The Aquaculture Division at SUN offer the following training in English and Afrikaans:

1) BSc Agric with Aquaculture as main subject (4 years) – candidate obtains a degree:

- Aquaculture with Agric Economics
- Aquaculture with Animal Science
- Aquaculture with Conservation Ecology

2) Post Graduate (Major in Aquaculture or Animal Science, Genetics, Agric Economics, Conservation Ecology etc) – candidate obtains a post graduate degree:

- BSc Agric Hons
- MSc Agric
- M. Phil: Livestock Industry Management

3) PhD

The University's Aquaculture Division also provides short course training (see point 3 and 4 below) for the public but currently it is exclusive to the farm-workers/small-farmers of the Freshwater Aquaculture sub-sector. Exclusivity is due to the shortage of financial and human resource capacity. The Head of the Aquaculture Division and has therefore indicated that the training be coordinated and driven by Aquaculture Institute of South Africa (AISA) and Cape Institute for Agricultural Training (CIAT – previously known as Elsenburg College).

3) Farm workers/Small Farmer – receives an attendance certificate No prior schooling is necessary in order to attend this course (5 days) which consists of: Three day component: Introduction to Aquaculture Farming Practices Two day component: Aquaculture & Business Management Course content: Basic Biology, Water Quality, Production systems, Fish Diseases, Business Management

4) New Entrants/Entrepreneurs (level between grade 12 and University) – candidate receives an accredited Diploma Certificate. A grade 12 (St. 10) qualification is necessary in order to attend this course (9 months), which can be conducted as:

5) Residential Programme (Theory: 6 modules + Practical Training: 6 weeks) – in some cases Learnerships (internships) are arranged where the candidate is placed on the farm to obtain on-farm training for parts of the year.

6) Satellite Distance Education Programme (Theory: 6 modules + Tasks: 6 weeks) which conducted over the internet.

Course content: Applied Biology, Water Quality, Production systems, Fish Diseases & Disease Management, Processing & Post-harvesting technology.

2. Coastal Engineering

The Department of Civil Engineering has the largest hydraulic laboratory in Africa where basic research and contract research are carried out in the fields of river hydraulics and coastal engineering. Mathematical modelling is however also used extensively to research river hydrodynamic and coastal

engineering problems. Stellenbosch University is the only University in Southern Africa where coastal engineering research is carried out. Current research focuses on:

- Optimisation of placement of concrete armour units for the construction of wave breaking structures (armour units include Dolos, Core-Lock, etc.);
- Optimisation of jet-type dredging pump;
- Current-wave interaction to determine the formation of freak;
- Waves in the Agulhas Ocean current on the main shipping route along the South African east coast;
- Hydraulics and sediment transport of intakes and outfalls of power stations.

3.2.1.8. Cape Peninsula University of Technology (CPUT)

CPUT runs courses in a wide variety of technical, scientific and commercial subjects at National Diploma, Bachelor of Technology, Master of Technology, Doctoral of Technology, advanced degree level and short courses. The short courses are run through the Centre for Continuing Education (CCE). It is a formal department and offers courses that are scheduled to make it possible for employees to complete them on a part-time basis. CCE short courses have long-term benefits and are focused on the development of skills. Also, by prior arrangement, most courses can be offered on site at the employers' places of business. Furthermore, customized courses can be developed to meet unique training needs.

Within its Applied Sciences department, the University offers modularized National Diplomas, B-Tech, M-Tech and D-Tech qualifications in environmental management, nature conservation, food technology, fisheries resource management and oceanography. The National Diploma in Oceanography has been offered for more than thirty years. This Diploma was developed specifically to meet the needs of the national fisheries management authority (MCM). The National Diploma in Oceanography is offered every second year and can accommodate up to 30 students. This is the only University in the country to offers programmes in technical training (Diploma) in Oceanography and Fisheries Resource Management. The University offers a B-Tech one-year full time programme and an M-Tech over two years in Oceanography. The University also offers an M-Tech and D-Tech in Environmental Health of which modules in environmental law, and marine legal issues.

3.2.1.9. University of KwaZulu-Natal (UKZN)

In the Faculty of Science and Agriculture the School of Biological and Conservation Sciences is managed across two campuses of the University of KwaZulu-Natal - Pietermaritzburg and Westville (Durban). The School was established from the merger of four separate units in January 2005 and became the discipline of Biological Science at Howard College (previously part of the School of Life & Environmental Sciences).

Other Schools include:

- The School of Botany and Zoology in Pietermaritzburg

Disciplines of Grassland and Wildlife Sciences in Pietermaritzburg

- The School of Biological Sciences in Westville

Research interests within the biological sciences are broad. Important research areas in the school include ecology, marine biology, biomarker development, plant and animal physiology, conservation biology, cellular biology, grassland science, evolutionary biology, entomology and systematics.

A programme in Biological Sciences (Marine Biology Stream) is offered. This is a special curriculum within the Biological Sciences programme that focuses on one of the strengths of the Durban Centre, and requires that students take specific modules aimed at training in Marine Biology. UKZN also offers a Masters degree in Marine and Coastal Management (MMCM), which comprise of four modules and a substantial research project. Elective modules include: Coastal Ecology, Marine Biodiversity, Ecotoxicology, Fisheries Science, Coastal and Marine Geology, Pollution Studies, Coastal Zone Management, Environmental Impact Assessment, Ocean and Coastal Law and Principles of Environmental Economics. The degree can be completed in one (full-time) or two (part-time) years.

3.2.1.10. University of South Africa (UNISA)

UNISA is Africa's premier distance learning institution. They are considered to be a reputable, comprehensive, flexible and accessible Open Distance Learning institution. The courses offered are internationally accredited qualifications and they have world-class resources. UNISA offers diploma in Nature Conservation that has modules related to marine fields. They offer BSc's in Environmental Management, Zoology and Botany. They also offer B-Tech, Honours, M and D level qualifications.

The defining characteristic of the new UNISA is its comprehensive nature. Broadly speaking, the term "comprehensive" refers to a combination of vocational courses usually associated with a Technikon, and general formative courses usually associated with a university. As a comprehensive university, UNISA, with a total student body (formal and non-formal) in the region of 250 000, offers a diverse choice of study fields at levels from certificate to degree, ranging from animal health, agriculture, law, business, education, humanities, to name but a few. UNISA is now also represented in all provinces of South Africa with strong outreach to SADC countries as well as other African countries.

Course design, development and delivery:

- **Course design**

Teams consisting of a number of specialists primarily develop UNISA courses. These teams are flexible and are constituted according to specific course design needs

- **Course delivery**

UNISA offers innovative delivery systems (e.g. interactive videoconferencing and online delivery) and student support in the form of Learning centres, Tutors, Contact, Counselling

- **Delivery systems**

Print based materials; Tutors; Technology support; Teleconferencing; Videoconferencing; Online learning.

3.2.1.11 North-West University (NWU)

The North-West University is a unitary, multi-campus institution with campuses spread across two provinces, with a single set of policies, systems and standards.

The four campuses:

- Mafikeng
- Mankwe
- Potchefstroom
- Vanderbijl Park

The above campuses function as business units with specific programmes and the institution follows a decentralised management system. A wide range of academic programmes with regional and national relevance is being offered at their campuses. The School of Environmental Sciences and Development has a vision to provide relevant value driven training and research of international standard, focussed on proven expertise within the environmental sciences and development. The structuring of the School, bringing together the basic biological subject groups such as Botany, Microbiology and Zoology with Geography.

Research projects are conducted in the following areas: Environmental Management, Ecological Remediation and Sustainable Development, Biodiversity and Conservation biology, Water Sciences and Town and Regional Planning. The Centre for Environmental Management (CEM) is serious about rendering environmental and occupational health and safety services to the broader Southern African community and is involved in many non-profit initiatives. NWU are in addition running an active internship programme, offering young professionals an opportunity to actively engage in CEM projects and training programmes, as well as to attend CEM courses, conferences and other events that promote fast tracked learning in the environmental management field. Post-graduate interns are normally ready to take up professional positions in the field of environmental, occupational health and safety management and governance, which can also provide environmental and occupational health and safety inputs to formal graduate and post-graduate programmes of various disciplines at the NWU.

The Centre offers the following courses for Environmental Management:

- Introduction to Environmental management
- Environmental Management tools
- Environmental and Occupational Health and Safety Law and management thereof

(<http://www.puk.ac.za/opencms/export/PUK/html/fakulteite/natuur/cem/training/courses.html> for more information on each course)

3.2.2 EVALUATION OF TECHNICAL TRAINING FACILITIES – (including government training programmes)

Technical training is seen as one of the top priority training areas, as there is a dire shortage in the region of trained oceanographic technicians and electronic technicians familiar with the design, maintenance and repair of marine electronic equipment. It has been recognised that technical training is particularly needed in the following fields:

- Oceanography
- Fisheries biology

- Aquaculture
- Data Management
- Numeracy
- Software applications
- Conservation Management

3.2.2.1. Cape Peninsula University of Technology (CPUT)

The only institution in the region, which trains students specifically as oceanographic technicians, is CPUT located in Cape Town. CPUT has successfully provided such training to a very high standard for more than 30 years through the 3-year National Diploma in Oceanography (see Section 3.2.1.8). Students can also commence to a Bachelor of Technology (B-Tech) degree following the National Diploma, which is completed in one year of full-time study or 2 years part-time. Master and Doctor of Technology degrees are also catered for. Matriculation (grade 12) in mathematics and physical science or biology is necessary to enrol for the Diploma. The B-Tech Oceanography Degree is considered to be a first degree according to South African Qualification Authority (SAQA). Through these courses, CPUT is able to provide the following tuition in the priority areas listed above:

- **Oceanography**

Students undertaking the Diploma in Oceanography receive instruction in basic mathematics, physics and chemistry, Introduction to Marine Biology and Ecology, Communication and Computer Skills in the first year. Students receive more specialist training in Physical and Chemical Oceanography in the third year, with lecturing being done by specialist part-time lecturers (e.g. MCM staff). Practical experience is provided during the experiential training period, which includes participation in a dedicated training cruise as well as in routine MCM cruises. More advanced training in the interaction between fisheries resources and MCM staff in the B-Tech course gives the physical and chemical environment.

At present the Oceanography Diploma course is run on a biannual basis, with an intake of about 30 first year students. This small intake is due to the relatively small demand for graduates within South African Research Institutions, and the limited capacity of MCM to provide experiential training. The number of students admitted to the course could be considerably expanded to accommodate students from other countries within the region if there was sufficient demand, and greater (i.e. regional) opportunities for experiential training. The biannual intake makes the provision of bridging courses for foreign students every second year a possibility.

3.2.2.2. Marine and Coastal Management (MCM) - Cape Town

Two other Departments following the National Election in 2010 have replaced the Department of Environmental Affairs and Tourism (DEAT). Instead of DEAT it's now recognized as:

1. Department of Environment and Water Affairs
2. Department of Agriculture Forestry and Fisheries

MCM are currently divided into both Departments above and are still orientated around fisheries, and the management of South Africa's marine living resources. MCM consist of scientific and technical staffs, which conducts research on all aspects of fisheries science from resource assessment, physical, chemical and biological oceanography to equipment and gear development.

3.2.2.3. CAPE Action Plan for the Environment (CAPE)

This programme was developed in South Africa with initial funding from the Global Environment Facility in 1998 focusing on the Cape Floristic Region. The programme has identified the key threats and root causes of biodiversity losses that need to be addressed in order to conserve the floral kingdom. Subsequently the recognition of areas which need to be conserved and a series of broad program activities, which needs to be undertaken over a 20-year period, were acknowledged and a spatial plan was proposed. The long term goal of the CAPE programme is to ensure that “by the year 2020, the natural environment of the Cape Floristic Region will be effectively conserved and restored wherever appropriate, and will deliver significant benefits to the people of the region in a way that is embraced by local communities, endorsed by government and recognized internationally”.

The programme has three over-arching themes that are its core drivers. These are to “establish an effective reserve network, enhance off-reserve conservation, and support bioregional planning; to strengthen and enhance institutions, policies, laws, co-operative governance, and community participation; and to develop methods to ensure sustainable yields, promote compliance with laws, integrate biodiversity concerns into catchment management, and promote sustainable eco-tourism”.

The CAPE programme has several core projects that have been designed to meet its goals. Projects worth mentioning that would complement the SAP-IMP project would be the Conservation Planning Unit, whose overall aim it is “to make a significant contribution to ensuring that comprehensive information and biodiversity pattern and process influence decision making for land use planning, development control, and setting conservation priorities within the Cape floristic region”.

3.2.2.4. Agulhas Somali Currents LMEs (ASCLMEs) & South West Indian Ocean Fisheries Project (SWIOFP) - COVERED ELSEWHERE IN THE MEDA

3.2.2.5. Ocean Data and Information Network for Africa (ODINAFRICA)

The Ocean Data and Information Network for Africa (ODINAFRICA) brings together more than 40 marine related institutions from twenty-five countries in Africa (Algeria, Angola, Benin, Cameroon, Comoros, Congo, Cote d'Ivoire, Egypt, Gabon, Ghana, Guinea, Kenya, Madagascar, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Senegal, Seychelles, South Africa, United Republic of Tanzania, Togo, and Tunisia). With the support of the Intergovernmental Oceanographic Commission of UNESCO and the Government of Flanders (Kingdom of Belgium) the network strives to address the challenges faced in ensuring that ocean and coastal data and information generated in national, regional and global programmes are readily available to a wide range of users in an easily understandable format.

The earlier phases of ODINAFRICA enabled the participating member states to get access to data available in other data centres worldwide, develop skills for manipulation of data and preparation of data and information products, and develop infrastructure for archival, analysis and dissemination of the data and information products. The member states also developed further the African network of sea level stations, bringing the number of operational tide gauges along the African coast to more than 40.

- ODINAFRICA Training

ODINAFRICA designed and implemented training programs tailored towards the individual needs. Training are based on accessing archived data, uploading own data as part of an existing program and a basic, intermediate and advance course in developing skills for manipulation and processing of data.

At the moment training is provided for; New institutions, Established institutions for refresher training and Continuous professional development training.

- *New partner institutions:*

Require a full cycle of training (basic, intermediate, advanced) customized to their desired level of expertise. This type of training is part of the Standard Curriculum provided by the OceanTeacher Academy is used (courses organized at the IOC Project Office for IODE).

- *Established institutions that need refresher training:*

Based upon the weaknesses identified either by the partner institution and/or by the assessment-customized training will be required. This training can be organized through an internship in one of the “Centres of Excellence” that will be designated as Ocean Teacher Academy regional nodes.

- *Continuous Professional Development Training:*

The rapidly developing technology requires regular training and re-training for all partners. Need for such training can be identified by the partner institutions but can also be highlighted by IODE. Such specialized training will be provided by the Ocean Teacher Academy. This can be done at the Oostende Campus or it could be done in one of the “Centres of Excellence”.

3.2.2.6. Global Biodiversity Information Facility (GBIF)

GBIF, the Global Biodiversity Information Facility, was established in 2001 and is donor and government funded. The mission of the GBIF programme is to facilitate the digitization and global dissemination of primary biodiversity data, which may in turn be made available to the global populations (from policy- and decision-makers, research scientists to the general public) to have access to the world’s supply of primary scientific data on biodiversity. GBIF strategy is to achieve its goals by setting up a worldwide network of participating nodes. A South Africa node called SABIF exists. This node is funded by the Department of Science and Technology through the National Research Foundation. See <http://www.gbif.org>

3.2.2.7. Global Ocean Observing System (GOOS)

GOOS are a global system for sustained observations of the ocean comprising the oceanographic component of the Global Earth Observing System of Systems (GEOSS). It plays a vital role in the international cooperation for sustained observations of the oceans, the generation of oceanographic products and services and the interaction between research, operational, and user communities. GOOS along with its funders have a comprehensive training programme and it has been “designed for the long-term, to be a true partnership between recipient and donor, be tailored to national and/or regional requirements, be flexible in scope, be sustainable and involve the user community.” This programme is implemented through an array of physical oceanographic workshops and training courses. From ocean colour courses and remote sensing courses to courses on sea level observation analysis. GOOS have also hosted Global Sea Level Observing System (GLOSS) courses in Portuguese and Spanish. In partnership with ODINAFRICA, GOOS also hosts courses and training workshops on data and information management.

3.2.2.8. Oceans Research

Its research is interdisciplinary ranging from biological to the socio-economic study of marine resource utilisation in Africa's coastal society. Oceans Research specialises in investigating the biology of marine mega-fauna, including sharks, rays, marine mammals and turtles, and advises governmental, non-governmental and industry on relevant conservation issues. Oceans Research

offers practical and theoretical training for aspiring marine scientists from internship to postgraduate levels in conjunction with partner schools, technical colleges and universities. In addition to in-house research projects, the institute provides facilities for visiting marine scientists conducting a variety of biological and oceanographic projects throughout the major marine biomes of Southern Africa.

3.2.2.9. Anchor Environmental

Anchor Environmental specializes as a Fisheries Observer Provider firm dedicated to providing quality observers for scientific research and environmental monitoring on board various fishing fleets and at designated landing sites around the South African coast. Drawing on comprehensive in-house resources, both within Anchor Environmental and the University of Cape Town (UCT), we have trained and provided high quality fisheries observers to collect catch and fishery effort data for domestic and foreign flagged commercial fisheries since 1996. Anchor Environmental Consultants CC is currently providing observers to South Africa's Marine & Coastal Management on both ship and land based observer programs. Our observers are dedicated to capturing quality scientific data and do not perform any compliance roles for domestic fisheries. Our experience to date has covered collecting data on fishing practices for line, trawl and net fisheries including:

- Hake longline
- Tuna longline
- Swordfish Longline
- Traditional Linefishing
- Tuna Pole
- Demersal Trawl
- Pelagic Trawl
- Gill Net
- Beach Seine
- Trap Fisheries including Rock Lobster

Observers are comprehensively trained to the highest standard at UCT by senior consultants and lecturers in subjects including Oceanography, Marine Ecology, Marine Life Histories, Fish Biology, Fish Identification, Observer Conduct, Sampling and Data Capture Techniques, Marine Navigational and Electronic Equipment, Shipboard Protocols, Safety and Survival at Sea and Fishing Methods. We provide training courses at the university to new observers before deployment concluding in an in-house exam. Details on the training course can be viewed [here](#). In-house training is further complemented by external lectures from groups such as Birdlife South Africa where our observers gain additional skills to report on a wide range of marine interactions. Ship based fisheries observers are deployed for variable periods at sea to collect data and compile reports on fishing practices including fishing effort, catch composition, length frequencies, by-catch, discards, marine mammal and seabird interactions, biological samples and a variety of other marine observations.

3.2.2.10. Global Ballast Water Management Programme (GloBallast) in conjunction with the National Ports Authority South Africa

The GloBallast programme has been operational since March 2000. It is funded through the GEF with its implementing agency being the International Maritime Organization (IMO) and its executing

agency being the United Nations Development Programme (UNDP). The Glo-Ballast programme is assisting developing countries “to reduce the transfer of harmful aquatic organisms and pathogens in ships' ballast water, implement the IMO ballast water guidelines and prepare for the new IMO ballast water Convention”. The programme is currently being implemented in several countries by using one demonstration site.

3.2.2.11. African Coelacanth Ecosystem Programme (ACEP)

At the end of 2000, recreational divers discovered a group of coelacanths in the Greater St Lucia Wetland Park, South Africa. This created the impetus for the development of the African Coelacanth Ecosystem Programme (ACEP). The programme was initiated in March 2002 with an expedition using the FRS *Algoa* and the German submersible *Jago*.

ACEP is a multidisciplinary project of South Africa, Mozambique, Tanzania, Kenya, the Comoros, the Seychelles and Madagascar that uses science to explore the deep unknown and develop sustainability, and ultimately to benefit people. The programme has taken advantage of the unique opportunity to lay the foundation for a project that should ultimately become a world leader in developing scientific excellence in offshore marine research. This programme has developed extensive experience on outreach and might provide some lessons learned for the SAP-IMP.

3.2.2.12. CapFish

CapFish aims to provide an International Marine Monitoring, Control and Surveillance service thereby enhancing the ultimate goal of achieving long-term sustainability combined with rational utilisation of the marine resources in Southern African waters as well as globally. This service will include coastal and high-seas waters and will be accomplished through the development of appropriate technology, training, deployment of scientific observers and compliance control as well as exploring the potential for the creation of employment opportunities. Emphasis will also be placed on empowerment and transfer of skills, particularly to the coastal communities. CapFish shall work closely with all sectors connected to the marine environment including local and international administrative, scientific and management bodies as well as interfacing directly with the fishing industry and industrial bodies.

- **Empowerment through training and development**

CapFish recognizes the need for a structured observer and staff training scheme and provide personalized in-house training for all observers.

CapFish gives observers and office staff training in:

- fish and crustacean biology;
- identification of fish species,
- seabirds and marine mammals;
- quota allocations and permit conditions;
- the basics of fisheries management,
- stock assessment,
- oceanography and the weather,
- international observer protocols.

A novice observer will often go to sea with a more experienced observer initially, and will usually start working on pelagic vessels, which only go on short trips of one to three days. Further, CapFish also recognized that there is an urgent need to provide basic seamanship and safety at sea skills. Therefore the company has initiated a basic training program together with the Cape Technikon Survival Centre. All observers are sent on a sea survival course to ensure that they are adequately prepared in the event of an emergency at sea. It is important to note that training also ensures that the observers and other staff are educated in responsible fisheries practices. From an environmental perspective this in turn leads to observers educating their communities about responsible fishing and the conservation of our coast, marine life and ecosystems.

3.2.3 EVALUATION OF RESEARCH INSTITUTIONS

3.2.3.1. MA-RE Institute UCT

The recently established Marine Research Institute (MA-RE) was officially constituted in October 2006 as one of the first signature themes at UCT. This was the culmination of a consultative process involving all marine researchers at UCT. It was agreed that, at an institutional level, UCT would greatly enhance its strength in the marine research and teaching field through formalised collaboration and coordination of all marine researchers and academics across disciplinary boundaries.

The MA-RE Institute will also strive to transform the marine field through capacity building and skills development. The MA-RE Institute is open to all marine-related research groups and individuals at UCT, studying the ocean and ‘salty waters’ of the coastal zone, as well as all issues influencing these areas (e.g. socio-economic, legal, historical etc., with a particular focus on implementing a co-ordinated multi-disciplinary research approach.

Vision of MA-RE

To establish UCT as an internationally recognized hub of excellence, and a premier higher education institution for multi-disciplinary marine research, teaching and training in Africa and the southern hemisphere.

The Fitzpatrick Centre of Excellence, within the MA-RE institute runs a Masters degree in Conservation Biology, which is one-year MBA-like programme, and it deals with the conservation and biologically sustainable and economically viable use of biodiversity. The coursework component is intensive and exacting, but represents a huge learning opportunity and the chance to interact with a wide range of excellent conservation biologists, both within and outside the university environment. It includes 7 months of intensive coursework and a 6-month individual research project.

Coursework consists of a series of modules, each taught by experts in their field. Modules typically include lectures, practical's, essays, discussion groups, seminars and field excursions. Reading lists are provided. Emphasis is placed on African examples and case histories. Appropriate computer courses are available for participants who do not have the relevant skills, but applicants are encouraged to develop at least rudimentary computer skills before enrolling. Modules fall into four different sections: an introduction, an ecological core, an interdisciplinary core, and a synthesis. Each module lasts between one and four weeks.

The introduction occupies the first three weeks and includes orientation, an overview of conservation biology, and a week studying the philosophy of science. The ecological core includes modules in community ecology, population ecology, biodiversity basics, aquatic ecology, molecular ecology, disturbance and restoration ecology, and invasion biology. It provides the education and training necessary Training and Capacity Building Strategy for Ecosystem Management to identify threatened species, ecosystems and ecological processes, and to develop appropriate measures to reduce the effects of, particular threats to biodiversity.

From a utilization perspective, it focuses on biological and socio-economic criteria necessary to select species and areas for utilization and the development of appropriate management and monitoring strategies. The modules cover a range of fields of conservation biology: characterizing biodiversity, modelling, demography of wild populations, population viability analysis, genetics, monitoring and time-series analysis, community-level interactions, invasive aliens, disturbance ecology, ecological socio-economics, landscape ecology (using geographic information systems - GIS), and decision analysis using applied management models.

3.2.3.2. Institute of Marine Environmental Law

The Institute of Marine Environmental Law forms part of the Law Faculty in UCT and was founded in 1980 to collate information and research to develop tuition in all aspects of the law of the sea. It publishes an annual journal *Sea Changes*, and monitors international developments in the field. Its work is the more relevant to the SA context because of the opening up of extensive offshore diamond fields off the SA and neighbouring Namibian coasts, and the development of offshore oilfields off the southern Cape coast. The Institute of Marine Environmental law at UCT offers a number of options for training, either for a recognized law degree, or for a post-graduate diploma in marine law.

3.2.3.3. The Environmental Evaluation Unit (EEU)

EEU is an independent; self funded research, consulting and training unit based at the University of Cape Town. The EEU consults, conducts research, training and community outreach as core activities of its operation. Their core areas of expertise are in the four thematic areas of integrated environmental planning, management and assessment, integrated coastal and small-scale fisheries management, biodiversity commercialization, fair trade and social justice, and public participation.

3.2.3.4. PLAAS

The Institute for Poverty, Land and Agrarian Studies is a leading research and training centre with an international reputation for high quality applied research and critical scholarship. A big part of the expertise of PLAAS is in fisheries management and aspects of community fisheries. PLAAS “engages in research, training, policy development and advocacy in relation to land and agrarian reform, rural governance and natural resource management.” PLAAS has been designing and developing a range of training short courses customized to meet the needs of different government departments and non-governmental organizations. These courses have utilized a wide range of participatory training methods, combined with analytic activities, scenarios and case studies and related content inputs. Certain courses have involved field-based learning sessions with participants engaging in guided fieldwork activities. Examples of such courses are *Social Science Perspectives on Natural Resource Management & Governance in Community Based Natural Resources*. PLAAS are currently running two projects: (1) *Poverty Alleviation and Sustainable Livelihoods in Small-scale Fisheries (POVFISH)* and (2) *Well-being among Fisher folks in Africa Research (WELFARE)*

- **POVFISH**

The POVFISH project aims to map out the effects of environmental insecurity and deprivation on poverty and food security in small-scale fisheries. This project also strives to understand and find a solution for alleviating poverty while maintaining a healthy ecosystem at the same time. Data is gathered by studying how poor communities cope with sustaining livelihoods through periods of resource crises. The focus lies with various institutions at different levels that enable collective action in communities that suffer from crises. POVFISH also investigates the capacity of institutions for poverty alleviation, resources stewardships and empowerment of the poor.

- **WELFARE**

WELFARE aims to investigate the root causes as to why fishing and coastal communities continue to be poor even after 1994. Macro-economic policy changes have played a big role on the reform of the industry and access rights continue to be a key issue. Some objectives of the project are: What are the implications of macro-policy change on the sectorial policy on poverty alleviation in fishing communities? Why is it that the SMMEs have not created the jobs that they were supposed to? What are the implications of long-term rights poverty alleviation? What key governance structures are needed to improve the poverty alleviation function of fishing and coastal resources?

3.2.3.5. Fishing Industry Research Institute (FIRI), Cape Town

The Fishing Industry Research Institute, now part of the South African Council for Scientific and Industrial Research (CSIR) has had a fifty-year research and technology partnership with the local fishing industry. FIRI has expertise in all facets of post-harvest technology such as the development of fish products, processing and engineering, factory layouts and pollution control, quality assurance and control and technology transfer. It also has training experience in various fields, including on-board technology, processing, Hazard Analysis Critical Control Points (HACCP), hygiene and microbiology.

3.2.3.6. Institute of Maritime Technology (IMT)

The Institute for Maritime Technology performs defence research to satisfy South African MoD strategic needs for techno-military support, products and services and to establish applicable technology and systems to further the interest of the SANDF. In order to achieve this, the Institute supports the South African National Defence Force with scientifically informed advice, the development of technology and strategic products to improve the performance of its systems.

The Institute for Maritime Technology (IMT) was founded in 1975 to provide science based technological support to the South African Navy for carrying out its seaward military operations. Initially work undertaken was aimed at naval operational research and the establishment of underwater technology. Over the years, capabilities have been developed to meet the growing demands of not only the SA Navy and other members of the maritime community, but also that of the other arms of service of the SANDF. Today the Institute for Maritime Technology, a Division of Armscor Business (Pty) Ltd is a multi-disciplinary company specialising in technological research and development, as well as specialised products and services. The Institute for Maritime Technology's main objective remains the capability to provide techno-military insight to the South African Navy. The Division consists of two business units namely:

- Naval Scientific Support Services (IMT)
- New Ventures

3.2.3.7. South African Marine Institute

The International School of Education (ISOE) Foundation established the South African Marine Institute (S.A.M.I.). S.A.M.I. is a newly established marine institute internationally recognized that focus on multi-disciplinary marine research, education and training. As a private institute, S.A.M.I. is in collaboration with the Cape Peninsula University of Technology (CPUT) to address various shortcomings in the marine sector in South Africa by developing new marine training related projects with CPUT.

Vision Statement

To be at the heart of Marine Education, Conservation and Innovation in Africa.

Mission Statement

Our mission is to develop and sustain the conservation of the marine environment through progressive social and economic, training and also research programmes and initiatives.

- R - Research
- E - Education
- S - Skills development
- C - Conservation
- U - Unity/Utilization
- E - Exchange programmes

The South African Marine Institute (S.A.M.I.) is a non-profit organisation that can facilitate a pivotal role in the community by bringing together the principles of sustainable utilisation of marine resources to sectorial role-players (communities, government and business) in a manner that will foster sound management practices that will benefit all.

3.2.3.8. South African Institute for Aquatic Biodiversity (SAIAB)

SAIAB is an interactive hub, focused on serving the nation by generating, disseminating and applying knowledge towards understanding and solving related conservation problems and the wise use of African fish and aquatic biodiversity. SAIAB is the custodian of the National Fish Collection, generates knowledge through research on aquatic biodiversity in Africa and trains and educates knowledge workers in aquatic biodiversity. It addresses national and international issues in aquatic biodiversity, through the priorities set by national and international funding agencies. The collection consists of about 80 000 fish specimens (containing at least 650 000 individual fish specimens) from southern Africa and surrounding oceans, and from elsewhere in the world. It is the world's largest collection of southern African fishes. As well as adult and larval specimens preserved in propanol and ethanol (the vast majority), the collection and associated material consist of preparations of genetic material, cleared and stained preparations, dry skins and skeletons, otoliths, X-rays, photographs, drawings and paintings of fishes. About 7 500 species in about 400 families are represented in the collection, depending on which classification is used.

Science challenges for SAIAB include building the flagship African Coelacanth Ecosystem Project, developing biosystematic capacity and developing an effective and integrated information-management system. SAIAB has an active rural outreach programme, the Bright Spark Club, which identifies high-potential candidates for science careers and gives them career-forming experiences over one year.

3.2.3.9. South African Environmental Observation Network (SAEON)

Saeon generates and archives reliable long-term information, relevant to the sustainable management of natural resources and habitat, over a range of ecoregions and land uses. These include pristine (wild) landscape, partially pristine (managed) landscape, agriculturally (rural) transformed landscape and urban transformed landscape. Saeon establishes innovative research platforms and information-management systems for long-term multidisciplinary, multi-institutional and participatory ecosystem studies, with strong regional and global linkages. These research platforms are co-ordinated as nodes, with the first one – the Ndlovu Node – established during 2004 in Phalaborwa. The second, the Elwandle Node, covers the coastal-inshore zone and was established in 2006 in Grahamstown, Eastern Cape. The launch of the saeon fynbos, the marine-offshore, the arid lands and the grasslands/

forests/ wetlands mosaic nodes are in the pipeline. Saeon is founded on three pillars, namely observation sciences, information-management systems and science-education outreach. It also runs an innovative education-outreach programme that focuses on educators, learners and postgraduate students.

3.2.3.10. Aquaculture Institute of South Africa (AISA)

The Aquaculture Institute of South Africa (AISA) operates as a non-profit organization and considers them being the “one-stop shop”. This developed from the need to bring Freshwater and Marine Aquaculture subsectors closer. The aquaculture Sector in South Africa has been discussing a separate co-ordinating body for several years. In 2003, the process leading to the formation of such a body was initiated and funded by the Western Cape Department of Economic Development and Tourism (DEDT). The body consisted of members from National and Provincial government departments, Industry and Tertiary Education Institutions.

- Vision

“To be a globally competitive Aquaculture sector in the Western Cape and in general in South Africa”

- Mission

“To promote the integrated development of a sustainable and equitable Aquaculture sector for the Western Cape and in general for all South Africans”.

3.2.3.11. Oceanographic Research Institute (ORI)

ORI is located at uShaka Marine World in Durban, KwaZulu-Natal and collaboration extend beyond the South African border to; Namibia, Kenya, Tanzania, Mozambique, Eritrea, Somalia and other countries of the western Indian Ocean region. The team consist of experienced marine scientists and capable support staff. Senior staff participates in numerous regional, national and international committees dealing with marine science and resource management. Affiliation with the University of KwaZulu-Natal, fulfil a postgraduate training role in marine science for post-graduate students and contributes significantly to awareness and capacity building in marine science. ORI has modest but effective facilities and equipment that include a comprehensive and up-to-date library, computer systems, fisheries databases, salt-water aquarium and Mariculture facilities, laboratories and competent underwater (SCUBA) survey capacities.

Scientific services:

A range of services in marine science is offered, including:

- Quantitative resource assessment, including artisanal, recreational, small-scale and industrial fisheries of southern Africa Biodiversity assessment
- Resource use, planning and development of management plans
- Sustainable coastal development
- Marine Protected Area (MPA) assessment
- Marine resource policy development
- Modelling of resource dynamics and usage

- Long-term monitoring of resource use
- Socio-economic assessment of marine resource use
- Marine related recreation and tourism
- Aquariology and mariculture

Training and capacity building:

ORI promote the training of students and foster the development of institutional and personal capacity in marine science. ORI contributes extensively to post-graduate supervision through the University of KwaZulu-Natal as well as at several other universities. ORI also runs training courses in other countries, often tailored to specific needs. It is ORI policy to enlist the collaboration of scientists from any host country that invites our expertise and, accordingly, many working relationships have developed between ORI and scientists in other countries.

Consulting services:

- Impact assessment on marine resources and ecosystems
- Coastal resources such as fishes, sharks and invertebrates
- Coral reef ecosystems of the western Indian Ocean
- Estuarine resources, including prawns, crabs and fishes.

3.2.3.12. *Integrated Marine Biogeochemistry and Ecosystem Research (IMBER)*

IMBER is a project, which is part of the International Geosphere-Biosphere Programme (IGBP) and the Scientific Committee on Oceanic Research (SCOR) project, focusing on ocean biogeochemical cycles and ecosystems. Its vision is “to provide a comprehensive understanding of, and accurate predictive capacity for, ocean responses to accelerating global change and the consequent effects on the Earth System and human society”. Although IMBER does not provide financial support for research, it serves to help coordinate national and regional IMBER research activities. IMBER does however provide funds for workshops, meeting and educational activities and applications can be made online. As a service to early stage researchers, IMBER posts all available conferences and short courses as well as cruise opportunities and fellowships on their website.

3.2.3.13. *Addressing Land-based Activities in the Western Indian Ocean (WIO-Lab)*

This project addresses some of the major environmental problems and issues related to the degradation of the marine and coastal environment resulting from land-based activities in the Western Indian Ocean region. It represents a strong partnership between the countries of the WIO Region, the Norwegian government, UNEP, and the GEF and is designed to serve as a demonstration project for the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities. One of the main objectives of the project is to develop regional capacity and strengthen institutions for sustainable, less polluting development. The programme has hardwired training and capacity building issues into its demonstration projects.

3.2.3.14. *Council for Scientific and Industrial Research (CSIR)*

The CSIR performs multidisciplinary research and technological innovation, with the aim of contributing to industrial development and the quality of life of people of South Africa – and increasingly on the wider continent. The council employs people who are experts in their fields and passionate about creating a better future through science. The CSIR is one of the leading S&T, R&D and implementation organisations in Africa. The CSIR’s main site is in Pretoria, and the organisation is represented in other provinces of South Africa through regional offices.

Core focus on science

The CSIR transfers the knowledge generated through research activities by means of technology and skilled people. The generation and application of knowledge reside at the core of the CSIR. These take place in domains such as biosciences; the built environment; defence, peace, safety and security; materials science and manufacturing; modelling and digital science; and natural resources and the environment.

3.2.3.15. Bayworld

Bayworld has two core functions, Research and Education. Research generates knowledge and thus Bayworld established a wide variety of research activities, such as fundamental research, interpretive research and applied research. However, the main research activity centres on its major non-living and living collections: marine mammalogy, herpetology, cultural history, otoliths and squid beaks. Consequently, research in these fields is encouraged. Bayworld promotes the dissemination of knowledge by reporting scientific discoveries in appropriate media, through teaching and by making its collections available to students and researchers from other institutions.

3.2.4 REGIONAL AND INTERNATIONAL NGO’S (including industry) - Programmes with TCB components

3.2.4.1. Scientific Committee for Oceanographic Research (SCOR)

SCOR was established in 1957 and over the years has become one of the leading non-governmental organizations for the promotion and coordination of international oceanographic activities. SCOR does not have the resources to fund research directly. The activity of SCOR focuses on promoting “international cooperation in planning and conducting oceanographic research, and solving methodological and conceptual problems that hinder research”. Thirty-five countries, of which South Africa is a member, are represented and participate in SCOR working groups and scientific steering committees for the large-scale ocean research projects.

SCOR promotes capacity building for marine scientists in developing countries and countries with economies in transition through special efforts to include such scientists in SCOR activities. Through travel grants as many as 75 individuals each year are funded, and this set to expand through a new activity entitled Regional Graduate Schools of Oceanography and Marine Environmental Sciences. See: <http://www.scor-int.org>

3.2.4.2. International Council for Science (ICSU)

ICSU was established in 1931 with the aim of promoting international scientific activity in the different branches of science and its application for the benefit of humanity. ICSU is funded through grants from other organizations and foundations, including a subvention from UNESCO. In the way of capacity development, ICSU provides opportunities for collaborative research through providing short-term seed funding of specific projects through the ICSU strategic grants programme. This programme is partially funded by UNESCO and is designed to “foster the interdisciplinary, international links which are necessary for the exploration of new scientific ideas and development of

future international initiatives". A typical proposal might be for a workshop or meeting to develop a specific scientific programme or assessment, although the range of activities supported is very broad.

ICSU also co-sponsors with UNESCO and the Third World Academy of Sciences (TWAS) a small-scale Visiting Scientist Programme. The aim of this is to enable institutions and research groups in least developed countries to establish links with leading international scientists. The grant provides travel support for short-term visits by senior scientists to institutions in developing countries.

3.2.4.3. Food and Agriculture Organization (FAO)

The FAO main thrust is in information distribution, sharing policy expertise and knowledge dissemination. One avenue through which it fulfils this mandate is through the production of comprehensive and exhaustive material, which can be used as training and capacity development material. These multi-media products called FOA Technical Guidelines include resources on ecosystem approach to fisheries, the economics of different fishing sectors (resource economics), fisheries management etc. While the FAO does not directly provide training, these resources can be fully utilized along with the FAO's virtual library to which all developing countries can receive access.

3.2.4.4. Western Indian Ocean Marine Science Association (WIOMSA)

WIOMSA is a regional professional, non-governmental, non-profit organization based in Tanzania. The organization is dedicated to promoting the educational, scientific and technological development of all aspects of marine sciences throughout the region of Western Indian Ocean with a view toward sustaining the use and conservation of its marine resources. Since 1994, when WIOMSA was established, capacity building has been one its core activities. The overall goal being to build technical and managerial capacity and professionalism to produce experts and practitioners capable of developing, disseminating and implementing effective coastal governance practice.

3.2.4.5. Council for Geosciences (CGS)

The CGS is the legal successor of the Geological Survey of South Africa, which was formed in 1912 by the merger of three former surveys, the Geological Commission of the Cape of Good Hope – was founded in 1895. The Geoscience Act, 1993 (Act 100 of 1993), established the CGS in its present form. The council is a modern institution, boasting excellent facilities and expertise, ranking among the best in Africa. The main functions of the CGS are: borders of South Africa; compiling geological, geophysical, geochemical and other geoscientific information; and publishing this information in the form of maps and documents other things, rocks, minerals, ores and fossils in South Africa and publishing research results in national and international journals.

The objective of the CGS is to:

To establish a safe, cost-effective physical infrastructure, effective and environmentally acceptable urbanisation and housing development clothe, transport, feed and provide shelter for the nation.

To accomplish these functions and objectives, the CGS maintains a specialised workforce, consisting of Earth scientists supplemented by technical, support and administrative staff at its headquarters in Pretoria, and branch offices in the Western Cape, Northern Cape, Limpopo, KwaZulu-Natal and the Eastern Cape. Geosciences information and services provided by the CGS are particularly important for the sustainable development of the country.

Although South Africa is situated on a relatively stable part of the Earth's crust, the CGS maintains a seismic network for recording such events within the national borders and coastal waters off South

Africa's coastline. This information is available to interested parties and helps mitigate the problems associated with mining-related seismic events. The CGS is a world leader in the domain of geophysical surveys, using a detection system deployed on light aircraft. In addition to its national responsibilities, the CGS is also active internationally, mainly in Africa. Geological and metallogenic maps of, among other countries, Angola, the Democratic Republic of Congo, Mozambique, Gabon and Morocco have been produced.

3.2.4.6. WWF

Within a global programme framework, the WWF network aspires to collectively tackle environmental issues. The Director General of WWF International, James Leape, has appealed to WWF offices worldwide to act as one WWF – with the best scientists, astute negotiators and working together as one global network, we can catalyse change on a global scale.

WWF South Africa

WWF operates within three discrete operational units:

- 1. Living Waters*
- 2. Living Lands*
- 3. Living planet*

The integrated strategy of WWF South Africa is underpinned by 8 primary goals to ensure that the biodiversity of the country is conserved and that our footprint remains within the earth's capacity to sustain life.

WWF aim to:

1. **Conserve** the biodiversity assets (endangered wildlife, species, habitats and ecosystems) of South Africa
2. **Ensure** natural ecosystems and their services are appropriately valued and integrated into sustainable development
3. **Play** a leading role among developing countries in addressing the risks and opportunities associated with climate change
4. **Improve** the livelihoods of communities who are most directly dependent on natural resources through better environmental practices
5. **Inform** South African consumers to influence appropriate environmental practice from the private and public sectors
6. **Instil** a culture of environmental responsibility in Business and Industry (including agriculture, fishing and mining)
7. **Advocate** for government policies incorporating sound environmental principles that promote, maintain and enhance biodiversity and ecological services
8. **Increase** environmental skills and capacity among current and future leaders

WWF training in South Africa

WWF are currently providing two types of training courses for capacity building in the country at set locations. First program is the aim to equip fishers, compliance staff, fisheries observers and managers with the skills and knowledge to implement an Ecosystem Approach to Fisheries Management. The second program recognises and applauds fishers who are making changes over and above what is required of them, to ensure healthy marine ecosystems and the benefits we derive from them.

1. Responsible Fisheries Training

For responsibly managed fisheries, it is important to understand the dynamics of individual populations and the ecosystem as a whole. It is equally important to have appropriate policies and regulations in place, which incorporate all aspects of an ecosystem approach, however, the fact that this is a necessary but not a sufficient condition is apparent. If the people on the ground like the fishers themselves, fisheries observers or compliance officers do not understand how and why regulations or management measures are in place there will be little or no implementation. Therefore it is vital that fishers who are at the coalface of fisheries management are empowered to understand the environment, within which they work, the concepts that underpin fisheries management and the thought process behind management decisions. Observers on the other hand require appropriate training to not only collect verifiable data on which management decisions are based, but are also inspired to raise the awareness and understanding of fishers at sea. Compliance officers, who enforce management actions, cannot do so effectively if they are not equipped with a thorough understanding of fisheries regulations, why the regulations exist and how to implement them. Benefits of the proposed training programme will ultimately result in fisheries acting more responsibly through improved compliance to fisheries regulations and implementation of voluntary measures and thereby increasing the likelihood of long-term sustainability and access to global markets. Many fishers have little tertiary education. A training programme such as this one would uplift the skills of fishers and in this way aid in poverty alleviation.

2. WWF Champion Skipper

Those at sea working directly with our marine resources have the power to inspire and directly implement change in the fishing industry. It is for this reason that the WWF Responsible Fisheries Programme (RFP) has initiated a project whereby individuals who are making significant changes in the fishing industry are recognised and acknowledged. We encourage all fishers to send in your stories about how things are changing in your fishery, and how you are having an impact. This is the type of commitment that WWF recognises and hopes to promote through the Champion Skipper programme. We hope that a skipper inspires others to make changes – big or small – to ensure we all have fish in the future.

WWF - South African Wildlife College

In 1995, WWF South Africa initiated, with the support of the Southern African Development Community (SADC) and other conservation organisations in South Africa, the establishment of the Southern African Wildlife College. The Southern African Wildlife College (SAWC) was set up as a Section 21 Company and built with a start-up grant provided by the German Development Bank and initial funds from WWF supporters. The main purpose of the college, which is situated close to the Kruger National Park, is to build much-needed capacity of professionals in the field of environmental and conservation management and to train a new generation of natural heritage managers, particularly protected area managers.

Since opening its doors in 2007, the SAWC has trained more than 3 000 individuals from the Southern African Development Community (SADC) and beyond. Trans-frontier conservation areas remain one of the focal points in the College curriculum and the training approach is designed to develop the specific skills needed for the effective management of these areas. WWF South Africa, through the support received from long standing donors (both local and international) and its

establishment of a capital fund in 2000, the Southern African Conservation Education Trust (SACET), continue to support the College.

3.2.4.7. African Centre for Climate and Earth Stewardship Science (ACCESS)

ACCESS is a relatively new concept that is still to be formally established. Its main goal is “building on, coordinating closely with, and complementing related, on-going activities in the earth sciences in Africa. The focus is on climate related phenomena that range from severe floods and prolonged droughts to climate changes in Earth’s distant past that can shed light on future global warming.” In terms of capacity and building ACCESS will play an active role in the development of e-courses, documentaries and other forms of communication and teaching resources? However, the core of ACCESS is a master’s degree in earth system science linked to research projects, which will involve the mentoring and tutoring of students. This, the core of the educational programme, offers courses, to students with a strong background in mathematics, physics, and chemistry, in topics such as: weather and climate, ocean-atmosphere interactions, biogeochemical cycles (of carbon, nitrogen, oxygen, rocks...) the history of planet earth, numerical (computer) modelling and mathematical and statistical methods.

ACCESS will also be actively involved in translating scientific findings to the benefit of society. This will be a measure of the effectiveness and impact of the programme on policy adjustment, adaptation strategies and in building societal resilience to global warming. In terms of operational oceanography, ACCESS will develop tools necessary for routine measuring and information dissemination of anticipated conditions in coastal waters, which will be of value to those who are involved in fisheries, shipping, tourism and the management of coastal zones in general. “The long-term plan is to transfer this capability (computer models etc.) to agencies, such as weather services, that have the infrastructure and that are experienced in providing the public with operational services.”

3.2.4.8. SysTem for Analysis, Research and Training (START)

START is an international programme whose core mission is to establish and foster regional networks of collaborating scientists and institutions in developing countries to conduct research on regional aspects of environmental change, assess impacts and vulnerabilities to such changes, and provide information to policy-makers. START also provides a wide variety of training and career development opportunities for young scientists. START's capacity building include fellowships, small grants, collaborative research networks and projects and research linked training - all primarily focused on developing and enhancing research capacity.

START's first capacity building efforts were research driven capacity building and closely twinned with the biophysical system oriented projects of the Global Change Research Program. The second generation of capacity building activities will be more integrative and will give greater prominence to human systems and their interactions with biophysical systems. This follows current trends in capacity development where emphasis is being placed on the important linkages between global and regional environmental change with human wellbeing and sustainable development, and focuses more explicitly on the application of global change science to better manage environmental risks. This is aligned with the mandates of the Millennium Development Goals.

START program capacity building

Specifically the next stage of Capacity Building will focus on:

“1) Needs of the least developed and low-income countries. Opportunities will be directed to countries identified as most vulnerable to the impact of global change and which have been

underrepresented in the first decade of START's capacity building programmes. These will include selected countries in Africa, South and Southeast Asia, and the Pacific.

2) In many instances this will mean initial capacity building with quality MA programmes, not only doctoral and postdoctoral programmes as in the first decade.

3) In this new phase greater emphases will be given to training in emerging cross-disciplinary and integrative approaches, e.g., those addressing assessment of impacts of environmental change, vulnerabilities and risks and of management and adaptation options.

4) A related thrust in the next phase of Capacity Building will be training of what has been termed "science policy amphibians" - individuals who are well trained in global change science but also capable of translating science findings into the policy arena. Such individuals are still lacking or in short supply in most developing countries and are especially needed in the least developed countries, which commonly lack a cadre of scientists to serve as advisors to their policymakers. In the absence of such advisors, the LDCs remain greatly disadvantaged in international negotiations as well as in the application of scientific advances to national development needs."

3.3 Other

3.3.1 SANCOR

What is SANCOR?

The South African Network for Coastal and Oceanic Research (SANCOR) is a non-statutory body that generates and communicates knowledge and advice in order to promote the wise and informed use and management of marine and coastal resources and environments.

What does SANCOR do?

- Provides a forum for interaction, collaboration and communication about science in the marine and coastal environment (SMCE), and generates debate on current issues.
- Contributes to planning for future demands on the marine and coastal environments and resources.
- Co-ordinates and integrates activities by stimulating appropriate inter-disciplinary and inter-institutional collaboration.
- Advises on the optimal use of financial, technical and logistical resources.
- Helps develop capacity in all sectors.
- Markets the benefits and promotes the use of research findings.
- Acts as a 'broker' between national and international funding agencies and researchers.

Source: <http://sancor.nrf.ac.za/about-us/Brochure.pdf>

Marine & Coastal Educators Network

What are Marine and Coastal Education?

Anyone who teaches others, adults or children, about the sea or the coast is involved in marine and coastal education. This includes teachers involved in formal education, educators at aquariums, educators and managers in conservation agencies, private educators, and marine scientists running awareness programmes, educators in non-government organisations and those working for the government, amongst others.

Who is MCEN?

MCEN stands for the National Marine and Coastal Educators Network (MCEN). The network was formed in 1998 under the auspices of our national research body, the South African Network for Coastal and Oceanic Research (SANCOR). The Network functions as the co-ordinating body for marine education in South Africa. The MCEN is an informal network, the aim being to assist marine educators in their activities, facilitates collaboration between educators, to help co-ordinate national marine education initiatives and to identify future opportunities for marine education in South Africa. The formation of MCEN was a great step forward as, prior to 1998, marine educators did not formally communicate with each other resulting in a very fragmented approach to marine education.

Source: <http://sancor.nrf.ac.za/Co-ordinating-Groups/sancor-groups/marine-education>

3.3.2. Southern African Institute for Environmental Assessment (SAIEA)

The SAIEA's mission is to "support sustainable development in Southern Africa through promoting the effective and efficient use of Environmental Assessment as a planning tool". This organization provides support to government authorities and other stakeholders by offering the following services:

- Guiding, monitoring and reviewing EA studies
- Monitoring the implementation of EA's and the impact of mitigation measures
- Basic and advanced training in EA
- Strategic research (e.g. EA effectiveness studies, sustainable development planning, Strategic Environmental Assessments, etc.)
- Needs-based information and networking
- Furthermore the organization offers a variety of courses, which can be tailor-made to the specific needs of the user. These include:
 - Public Participation in Environmental Assessment
 - Cleaner Production for SMEs
 - Tools for Sustainable Development in Africa
 - Environmental Assessment Quality Control

3.3.3. International Ocean Institute (International) & IOI-SA

The IOI- International subscribe to the mission of ensuring the sustainability of the oceans as the "source of life" and uphold and expand the principle of the common heritage as enshrined in the United Nations Convention on the Law of the Sea. Its core strength is in training and capacity development for coastal communities through various programmes, some of which focus on training the youth and women. It also produces research and policy-related publications dealing with ocean governance and ocean science.

IOI-SA (one of IOI-International's operational centres) based at the University of the Western Cape, mission is to "develop and offer high quality capacity building and research programs that improve

upon the sustainable livelihoods of poor and underprivileged people living in coastal areas. IOI-SA responds to on-going assessment of the factors that contribute to livelihoods within the southern African region. IOI-SA maintains a particular focus on; rural coastal communities, decision-makers, university students at postgraduate level, and schools. It achieves its mission through networking with other organizations in the region that are active in the sphere of marine and coastal management, and sustainable livelihoods.” IOI-SA has been able to undertake a number of training activities through the IOI-SA Training Programme. The programme develops and delivers training in support of good governance of oceans and coasts for various stakeholders. These include programmes under the following four themes people, oceans and coasts, biodiversity and informatics, education through technology and the IOI- SA online services.

All training and capacity building activities of the IOI network are joined under the Ocean-Learn banner, co-ordinated by the Ocean-Learn Implementation Committee (OLIC). This committee facilitates the hosting of network-wide quality standard for all courses run under this brand. One of its current initiatives, which the IOI-SA is pursuing in conjunction with the University of the Western Cape, is the development of a Master of Science (18 months) with a particular focus on ocean management and governance. The course aims to cover crosscutting, multi- and inter-disciplinary issues from policy and legislation development to law of the sea and society interactions and communication skills. Currently the course is still in its planning phase and has not been formally adopted by the university.

3.3.4. TRAIN-SEA-COAST (TSC)

The TRAIN-SEA-COAST Programme was established in 1993 by the United Nations Division for Ocean Affairs and the Law of the Sea (DOALOS), Office of Legal Affairs, with first the financial assistance of the United Nations Development Programme (UNDP/BDP). The overall goal of the Programme is capacity building at the local level, thus emphasizing: a) the build-up of permanent national capabilities; b) sustainability of efforts; c) cost-effectiveness; d) responsiveness to the specific needs of the countries involved; and e) long-term impact. This United Nations (DOALOS) based organization has several units internationally including one based at IOI-SA in South Africa. The mission of the TRAIN-SEA-COAST Programme is to create capacity at the local level for the development, delivery and adaptation of high quality training courses that meet TSC standards and are tailored to specific training needs at the local, national and regional levels.

The main objective is to enhance national/regional capacity building through training on key trans-boundary topics/problems in the area of coastal and ocean matters. TSC has its own course development methodology, which it can apply to a range of training courses. One such course in Oil Spill Management has been conducted in the region and it also has access to other relevant courses developed elsewhere for delivery in the region.

Conclusion:

It is evident that there is a wealth of training and tuition facilities and courses available in the region (with the bulk in South Africa). However, much of what is on offer is at the tertiary level for undergraduate and post-graduate academic tuition. There are a number of suitable short course, but more importantly, a number of the institutions listed have the capacity of developing and hosting tailored courses to meet the some needs presented in section 2.

Evaluating training and capacity building activities will aid in the development of local education capacity to increase self-reliance and hence to create an opportunity for tuition to be tailored in the region according to its needs. An increased self-reliance (via a skills pool) could create an opportunity to improve marine science education in communities in the region as a whole. To achieve this one needs fully functioning and well-established training centres that can receive a funding capacity to train people in the different fields of Marine Science (short courses). Short courses will be

the key to uplift marine education capacity and skills development within the country. This will improve the continuity and longevity of programmes in the region, which can open career paths in the future.

The evaluation of training activities of which include short courses, mentorship and training of trainers is one of the areas that the ASCLME Training plan focuses on. Emphasis is placed on education for instructors and teachers as current teaching skills need to be strengthened and create more focus areas where training programmes can be implemented. Capacity Building and Training (CB&T) within South Africa can improve by sharing expertise and creating networking opportunities within various marine sectors, communities and organizations. Skills training in various aspects of environmental work have also taken place at provincial level of which some include;

- Provincial workshops to raise awareness and offer training on Local Agenda 21 and environmental indicators,
- Development of guidelines covering a wide range of topics, including environmental impact assessment, waste collection, and recycling.

There is an urgent need, however, to develop the skills and capacity of local government to introduce the concept of sustainable development in all planning and service delivery activities. The education system in South Africa is divided into a formal and non-formal system. The formal system comprises Primary, Secondary and Higher education. The informal system comprises of a wide variety of training on a number of levels (similar to that of the formal sector) made up of bands and is directed by the SETA's. At the lowest levels are Adult Basic Education (ABET), followed by higher levels (see Table.1). The greatest challenge for marine CB&T in South Africa is that the informal education sector is not co-ordinated in any way. As a result, there is no infrastructure to facilitate informal CB&T, which is the area where it is needed most.

4. National needs and capacity for meeting them

The needs and priorities for providing training in marine science and technology within the country, are set out below. These were identified through South African research institutes and tertiary educational institutes. Each of the major training needs is tabulated (Table 3) and below a short description that specifies the capacity for meeting the needs for training in a specific industry.

4.1. Technical training

Technical training as identified in Section 3.2.2 is the identified area within Marine Science that needs to increase. Tertiary Institutions within South Africa provide excellent educational based training but CPUT is the still the only Tertiary Institution to provide technical training (see Section 3.2.2.1). Private organizations also contribute extensively to the training of marine technicians and some of the leading organizations include, IMT, CSIR and MCM (information on each see Section 3.2.2. & 3.2.3). Each one provides training in either one or more areas in Marine Science mentioned in Section 3.2.2. But there is no institution in South Africa that can provide training in all the identified areas mentioned in 3.2.2.

Numeracy is one of the areas where capacity is needed because of a limited number of scientists bearing the skill e.g. statistics and modelling. This leads to an overload of work for scientists bearing such skills. Short courses are proposed for both statistics and modelling, as only basic stats are being taught currently (Tertiary Institutions) but no modelling unless an individual take part in a 3-year degree program. A formal action plan is proposed not only for Numeracy but also the other areas that lack in technical training.

4.2. Economics and socioeconomics

The South African coastline is renowned for its high marine biodiversity and immense natural beauty. The coastal and marine ecosystems along the coast are known to play an important role in providing essential sources of livelihood and income for numerous coastal communities. Impacts of fishing communities can be very visible in all types of fishing sectors, which include, commercial, artisanal, aquaculture, ornamental, sports and non-consumptive (e.g. whale watching) sectors.

Coastal and marine resources provide the basis for a substantial proportion of economic and social activities in South Africa and the rest of the African coastal regions. At present there is little economic and social research compared to the biological sciences. This is a major gap, requiring attention.

PLAAS, the Institute for Poverty, Land and Agrarian Studies are currently running two long-term programs which target livelihoods of Small-scale fishermen (POVFISH) and the well-being among Fisher folks in Africa Research (see Section 3.2.3.4).

4.3. Numerical expertise (statistics, applied mathematics etc)

Fisheries scientists in the SA region generally lack the numerical and statistical expertise needed for many of the quantitative aspects of their work. This has placed an inordinate load on the few scientists who do have such expertise, and makes the region very vulnerable to the loss of their skills. The root cause is the tendency for students in the life sciences at universities to avoid mathematical subjects, an attitude that probably originates to some extent at school.

Improvement in numeracy is particularly needed for work in the following areas:

- Stock assessment (population dynamics, risk analysis etc.)

- Statistical analysis and biostatistics (survey and experiment design, data analysis and interpretation etc.)
- Modelling (populations, physical and biological processes, bio-economics, socio-economics)
- Ecosystem modelling (energy budgets, multi-species interactions etc.)

Higher Institutions such as UCT, CPUT, UWC and others as in Section 3.2.1 range from offering limited to extensive educational based training. Hence, as mentioned in Section 4.1, these institutions require a minimum of 3 years study. The proposal as in Section 4.1., can also be accountable here, to implement short-courses to address problems in numeracy.

4.4. Data management and information management skills

The availability of reliable, up-to-date, accessible data and information is an essential basis for integrated coastal area management (ICAM), and sustainable management of coastal and marine resources. Large amounts of data are collected daily from diverse sources such as equipment installed on the shore, moored and drifting buoys, research ships and merchant ships, aircraft, and satellites. The users and uses of these data also vary and include industries, fishermen, coastal communities, academics, researchers and resource managers.

Though the primary user of the data may have no further need for the data after utilizing it for the purpose it was collected, they are often valuable to subsequent users. Data Management in South Africa at the moment are governed, archived and organized by a few institutions (see Section 3.2.2), but more attention to data storage and accessibility is required.

4.5. Legal expertise

Nationally, South Africa's natural environment is governed by a wide range of legislative acts, including the Constitution of the Republic of South Africa (1996), National Environmental Management Act (No. 107 of 1998), the Environmental Conservation Act (No. 73 of 1989) and, of greatest relevance to marine and coastal resources, the Marine Living Resources Act (No. 18 of 1998).

The Marine Living Resource Act (MLRA) for the first time recognizes the subsistence fishing sector and incorporates the fact that many coastal communities of South Africa derive their livelihoods directly from marine resources. This act has greatly widened the parameters of management requirements since 1999, contributing to the overall improved marine legislation.

The three fundamentally important pieces of South African environmental legislation are:

1. The Constitution of the Republic of South Africa Act, 1996

The constitution entrenches the fundamental right of every person to the environment. Section 24 affords to everyone a right to:

- to an environment that is not harmful to their health or wellbeing;
- to have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution, promote conservation and secure ecological sustainable development.

2. The National Environmental Management Act, 1998

The National Environmental Management Act is intended to integrate environmental management countrywide, by establishing principles to serve as a general framework for environmental matters

and providing guidelines for the interpretation, administration and implementation of the National Environmental Management Act and any other environmental law.

3. The Environment Conservation Act, 1989

The Marine Living Resources Act, 1998: Provision is made for conservation of the marine Eco-system, the long-term utilisation of marine resources and control of marine resources in a fair and controlled manner. Licensing, rights of access, seasons, fishing and other matters are dealt with in terms of regulations made under the Marine Living Resources Act.

Training and capacity building in marine legislation

There are few fisheries lawyers, and bridging the skills gap within coastal regions of South Africa is a priority. Tertiary Institutions offer Marine Law courses either specialized (Maritime Law) or part of the LLM degree. Such Law students undertake at least a 3-year degree program (see Section 3.2.1.).

The availability of short courses in marine and environmental law in SA is very limited but some courses are offered through the School of Law at the University of the Witwatersrand (WITS) in Johannesburg. The University of the Northwest, Centre for Environmental Management (see Section 3.2.1) also provide a number of short courses.

4.6. Language education

South Africa needs additional training in scientific and technical English. General courses in English are widely available within the region, but courses in scientific and technical English are less so. Courses possibly suitable for foreign students and researchers are an introductory course offered at UCT.

4.7. Governance

Environmental communication and education is an important part of community development, communicating conservation issues, alleviating poverty and socio aspects to the fisheries. There is currently a big gap in communication from governance to coastal communities regarding implementations of policies and new decisions regarding policies i.e. no governance of government. Currently no round table discussions or short information briefings are in place to discuss policies with communities.

4.8. Fisheries science

Fisheries Science is covered fairly substantially at University level, however training of managers and the users on the basics remains a priority.

4.9. Oceanography (Physical, chemical, biological)

A centre of excellence in Africa

4.10. Coastal zone management including expertise in GIS and MPA's

Adequate, through a range of institutions including NGO's such as WWF; see Figure 1. GIS training are offered as a part of a 3-year degree at Universities but short courses are already underway from other institutions in SA (see section 3.2.1 and 3.2.2).

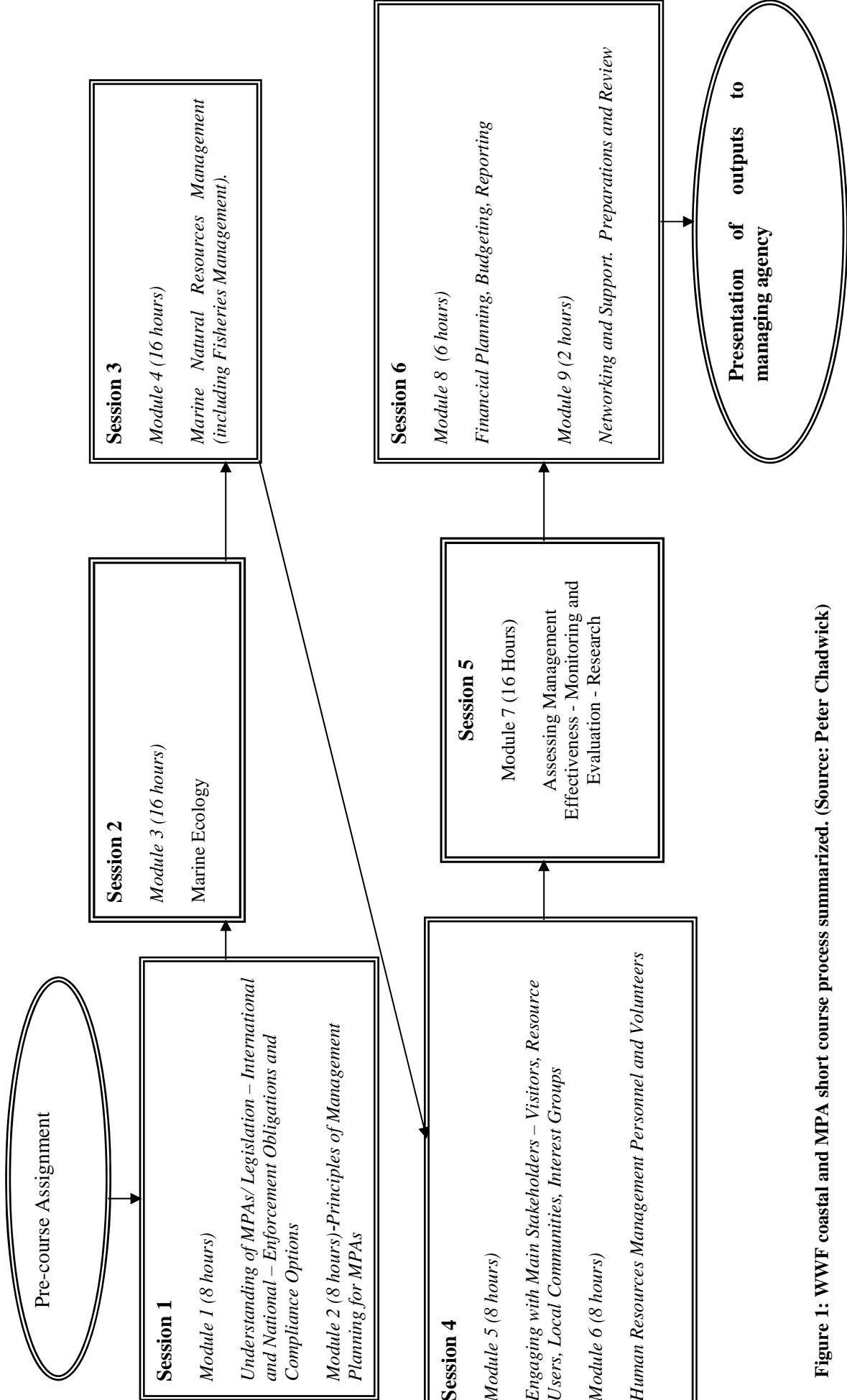


Figure 1: WWF coastal and MPA short course process summarized. (Source: Peter Chadwick)

2. WIOMSA

The objectives of the WIOMSA capacity building programme are to: “Build and strengthen the institutional and human capacity for integrated coastal Management (ICM) and Marine Protected Areas Management (MPA). Strengthen technical capability to implement international conventions related to coastal and marine environment. Strengthen the capacity to use science for management in areas such as remote sensing modelling and Mariculture. Support to institutions, upon request in the development and implementation of the capacity building activities in the WIO region.” In addition to the on-going capacity building program in ICM and MPA, WIOMSA has organized/hosted a number of regional workshops and meetings that provided the linkage between science and management.

4.11. Geology and Geomorphology including mineral extraction

Geology and Geomorphology including marine aspects re currently offered as degree programmes at Universities (See section 3.2.1). There is currently a National need for training on FET and HE level as overall expertise are low (see Table. 3).

4.12. Aquaculture

South Africa considered a centre of excellence in Africa, through Stellenbosch and Rhodes University.

4.13. Climate research

A number of institutions involved; UCT, MARE, ACESS to name a few (See section 3.2.2-3.2.3 and Table. 3).

4.14. Environmental Education, human health

The South African National Health Knowledge Network was established in 1999 at the MRC with funding from the Government’s IF. The network operates under the trade name SA HealthInfo and is available on the Internet at www.sahealthinfo.org. It provides a one-stop interactive forum or resource for quality-controlled and evidence-based health-research information. At the moment there are programmes who offer training both Environmental Education and Human Health although more can be done (START program see section 3.2.2). More can be done and programs should implement a system of being more sectors specific. This will ensure a system/ environmental education network where short courses are designed for each target sector (see also Table. 3).

4.15. Tourism

The World Tourism Organization (UNWTO/OMT), a specialized agency of the United Nations, is the leading international organization in the field of tourism. It serves as a global forum for tourism policy issues and practical source of tourism know-how. The Tourism body in SA the, South African Tourism Organization, is a national tourism agency responsible for the international marketing of South Africa as a preferred tourist destination. Its aim is to make tourism the leading economic sector in South Africa, and to promote sustainable economic and social empowerment of all South Africans.

At the same time South Africa is marketed as an integral part of Africa and particularly the subcontinent of southern Africa. Tourism is one of the fastest growing sectors of South Africa’s economy. Directly and indirectly, tourism constitutes about 7% of employment in South Africa. The tourism industry forms part of the Accelerated and Shared Growth Initiative for South Africa’s

(AsgiSA) goals to reduce poverty and unemployment; and to raise the level of economic growth by at least 4,5% in the next few years and to an average of 6% between 2010 and 2014. Tourism has been identified as one of the key economic sectors with excellent potential for growth.

Responsible tourism implies a proactive approach by the tourism sector to the environment through the promotion of balanced and sustainable tourism. This is particularly important where the focus of the tourism sector and of the activities of tourists is the natural environment, as is the case with wildlife viewing, hunting and marine tourism. There are particular challenges in making nature-based tourism sustainable. Responsible tourism development has to be underpinned by sustainable environmental practices. In the environmental sphere only conservative decisions based on the precautionary principle can be considered responsible. Cultural heritage is also part of the environment, and the responsibility of the tourism sector towards the cultural environment was considered in the social responsibility guidelines.

The Tourism trade to environmental responsibility is targeting larger businesses which should be using Environmental Management Systems to exercise environmental responsibility; for businesses, a defined size, in each sector it would be irresponsible to operate without responsibility.

- **THETA**

Theta, the Tourism, Hospitality and Sport Education and Training Authority, is the Sector Education and Training Authority (SETA) established under the Skills Development Act (No 97 of 1998) [the Skills Act] for the Tourism, Hospitality and Sport Economic Sector. A SETA's main function is to contribute to the raising of skills - to bring skills to the employed, or those wanting to be employed, in their sector. In order to ensure appropriate skills are developed for the sector THETA has to develop a sector skills plan, implement this plan, implement quality assurance, and disburse levies collected by employers in the sector and report to the Minister of Labour and the South African Qualifications Authority. The National Environmental Education Programme is a collaborative project coordinated by the Department of Education. Its purpose is to support teachers in implementing environmental education at schools, and integrate it with the outcomes-based curriculum. In addition to the above it is also recommended that more organizations are involved in teaching and educating tourists visiting SA and can also propose that a "Information's guide to SA's Oceans-Be a responsible tourist" can be developed to distribute between leading hotels and guesthouses in SA to aid in a National Training Initiative.

4.16. Training of inspectors and observers, community involvement? (MCS, including pollution etc)

The fisheries monitoring, control and surveillance (MCS) task requires two distinct groups of people: compliance enforcement officers (inspectors), who enforce the laws and regulations and have statutory quota control functions, and observers, who collect data from commercial vessels and observe and report on possible infringements but do not have law enforcement powers. The training programmes for these two groups will of necessity be different, but will have certain aspects in common.

A well-trained, motivated and responsible corps of inspectors and observers is vital for the effective management of marine living resources. In South Africa, the numbers of MCS personnel are inadequate for the task entrusted to them due to over population on coastal areas.

Observers require more training in the scientific aspects of their work to improve the quantity and quality of the data that they collect, much of which is highly useful for resource and environmental monitoring. South Africa has sufficient observers with tertiary education to meet present needs, but will have a shortage in the future as the demands of international treaties increase and the need for commercial data to be collected at source becomes greater. Observers are currently be further trained

by institutions such as, MCM and CapFish (see section 3.2.2) after/during their time at tertiary institutions.

Regional training opportunities for both groups are outlined below.

- Fisheries compliance officers
- Observers

Short courses are needed in all coastal regions in fields outlined above. Once a course is completed the student should be able to be contracted by Government in order to manage the seas in his/her region. This will help capacity building and alleviate poverty and poaching along the coast.

4.17. Trans-disciplinary training for managers including ecosystem approach

Most of the fisheries managers in the region are either administrators or scientists (mainly biologists). These managers, while skilled in their fields, often lack sufficient understanding of the other disciplines required for effective fisheries management, and need to be educated outside their disciplines in fields such as fisheries biology, the economics of resource exploitation, socio-economics and marine law.

The region's universities and other higher education training can provide much of the necessary training in each of these disciplines. However, no integrated multi-disciplinary courses at the appropriate level have as yet been designed, although DIFS at Rhodes University offers a short course in fisheries management, which could be broadened into a suitable multi-disciplinary management course to meet the region's needs (see section 3.2.1.).

4.18. Biodiversity, Taxonomy and EIA Training

Biodiversity, Taxonomy and Environmental Impact Assessment (EIA) training other than at those from tertiary institutions are very limited. It is accepted that there are a number of challenges facing EIA, one of which is the serious lack of EIA capacity that exists within civil society. This lack of understanding environmental concerns, consequences, benefits and rights is a serious area of concern.

The WESSA Organization provides training to aid capacity building on EIA's across SA and use the diagram below as a working model to promote environmental education.

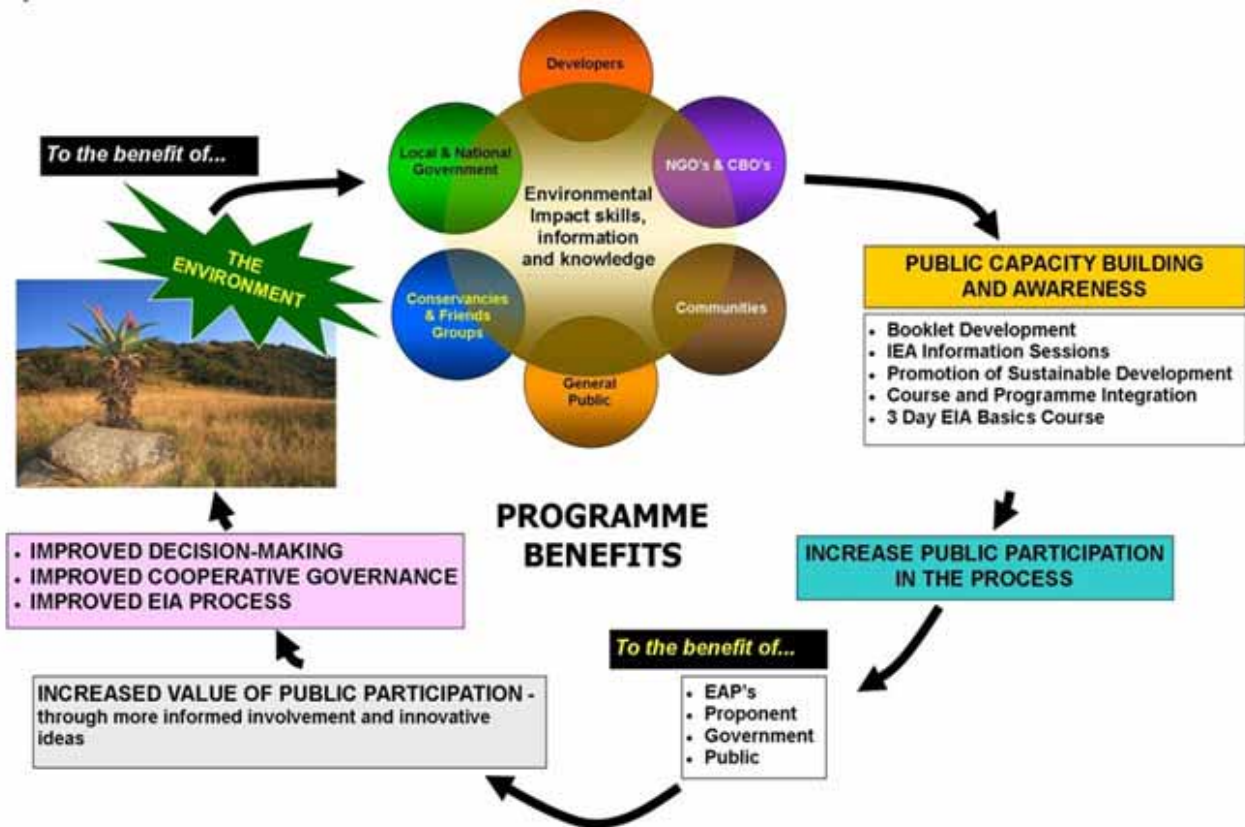


Figure 2: Diagram indicating a working model to promote environmental education. (Source: <http://www.wessa.org.za/index.php/Conservation/Environmental-Impact-Assessment.html>)

The Iziko Museum in Cape Town, Just Blue, and SAIAB provide a taxonomy identification service. Additional training is needed in all three sectors and should also be included at GET, FET and HE NQF levels (see Table. 3)

4.19. Pollution: land and marine based

Expertise on marine and land pollution is currently vary limited in SA (see Table. 3)

Table 3 below is a summary of the CB&T needs for all marine sectors as described in Section 4. The key shown below is a guide to acronyms used within Table 3.

KEY:

Range: N = National, R = Regional / Provincial, L = Local (Community / City);

Offered: N = No, SC = Short course, Diploma = Dip, Deg = Degree

Expertise: L = Low, M = Medium, H = High

Priority: L = Low, M = Medium, H = High

Potential Provider:

DEA: Department of Environmental Affairs

DAFF: Department of Agriculture Forestry & Fisheries
Private = Private Trainers (in particular for short courses)
UCT – University of Cape Town
UWC = University of the Western Cape
Univ = Universities
FET =Further Education & Training Institutes

Table 3: Summary of CB&T needs for the marine sectors described in Section 4.

	Topic	Need		Current Capacity		Priority	Potential Provider	
		NQF Level	Range	Offered	Offered			Expertise
Technical Training								
1	Oceanographic maintenance & calibration	FET & HE	N	SC; Dip; Deg	Dip; Deg	M	H	UCT; CPUT; Private; DEA; DAFF
2	Ocean surveys	FET & HE	N	SC; Dip; Deg	Dip; Deg	L	M	UCT; Private; DEA; DAFF
3	Marine / Coastal Field surveying	GET, FET & HE	N	SC; Dip; Deg	Dip; Deg	M	H	Univ; Private; DEA; DAFF; FET
4	Fishing Gear	FET & HE	R	SC; Dip; Deg	Dip; Deg	L	M	UCT; Private; DEA; DAFF
5	Electronic Instrumentation	FET & HE	N	SC; Dip; Deg	Dip; Deg	H	H	UCT; CPUT; Private; DEA; DAFF; FET
6	Water Quality Monitoring	GET, FET & HE	N	SC; Dip; Deg	SC; Dip; Deg	M	H	Univ; Private; DEA; DAFF
7	Operational Oceanography	GET, FET & HE	N	SC; Dip; Deg	Dip; Deg	M	H	
Economics and Socioeconomics								
1	Eco tourism	GET, FET & HE	N	SC; Dip; Deg	SC; Dip; Deg	M	H	Univ; Private; DEA; DAFF

2	Fisheries Economics	HE	N	SC; Dip; Deg	Deg	M	H	Univ; Private; DEA; DAFF
Numerical Expertise								
1	Stock Assessment	FET, HE	R	SC; Dip; Deg	Dip; Deg	L	M	Univ; Private; DEA; DAFF
2	Ecosystems Modeling (EAF)	FET, HE	N	SC; Dip; Deg	Dip; Deg	L	H	Univ; Private; DEA; DAFF
3	Acoustics	FET, HE	R	SC; Dip; Deg	Dip; Deg	L	M	Univ; Private; DEA; DAFF
Data Management and Information gathering skills								
1	Data analysis & experimental design techniques	GET, FET & HE	N	SC; Dip; Deg	Dip; Deg	L	H	Univ; Private; DEA; DAFF
2	Data Management	GET, FET & HE	N	SC; Dip; Deg	Dip; Deg	M	H	Univ; Private; DEA; DAFF; FET
3	Vessel Monitoring Systems	GET, FET & HE	N	SC; Dip; Deg	N	L	H	Univ; Private; DEA; DAFF; FET
Legal Expertise								
1	Environmental & Marine Law	GET, FET & HE	N	SC; Dip; Deg	SC; Deg	L	H	Univ; Private; DEA; DAFF; FET
2	Resource Management	GET, FET & HE	N	SC; Dip; Deg	Dip; Deg	M	H	Univ; Private; DEA; DAFF; FET

Language Education							
1	English as a second Language	GET, FET & HE	N	SC; Dip; Deg	M	H	Univ; Private; DEA; DAFF; FET
Governance							
1	Extension Services (community governance)	GET, FET & HE	N	SC; Dip; Deg	M	H	Univ; Private; DEA; DAFF; FET
2	Policy Development	GET, FET & HE	N	SC; Dip; Deg	L	M	Univ; Private; DEA; DAFF; FET
Fisheries Science							
1	Fisheries Management	GET, FET & HE	L	SC; Dip; Deg	L	M	Univ; Private; DEA; DAFF; FET
2	Ichthyology	GET, FET & HE	R	SC; Dip; Deg	M	M	Univ; Private; DEA; DAFF; FET
3	Fish Identification	GET & FET	L	SC	L	H	Private; DEA; DAFF; FET
Oceanography							
1	Remote Sensing	FET; HE	N	SC; Dip; Deg	L	H	Univ; Private; DEA; DAFF; FET
2	Oceanography	FET; HE	L	SC; Dip; Deg	L	M	Univ; Private; DEA; DAFF; FET

Coastal Zone Management (GIS & MPA)									
1	GIS & Mapping	GET, FET & HE	N	SC; Dip; Deg	SC; Dip; Deg	M	H	Univ; Private; DEA; DAFF; FET	
2	MPA	GET, FET & HE	N	SC; Dip; Deg	SC; Dip; Deg	M	M	Univ; Private; DEA; DAFF; FET	
3	Co-management of coastal communities	GET, FET & HE	N	SC; Dip; Deg	SC; Dip; Deg	L	H	Univ; Private; DEA; DAFF; FET	
4	Coastal Engineering	GET, FET & HE	L	SC; Dip; Deg	Dip; Deg	L	H	Univ; Private; DEA; DAFF; FET	
Geology and Geomorphology including mineral extraction									
1	Geology & Geomorphology	FET; HE	N	SC; Dip; Deg	Deg	L	M	Univ; Private; DEA; DAFF; FET	
2	Mineral Extraction	FET; HE	L	SC; Dip; Deg	N	L	M	Univ; Private; DEA; DAFF; FET	
Aquaculture									
1	Aquaculture Systems	GET, FET & HE	N	SC; Dip; Deg	SC	L	H	Univ; Private; DEA; DAFF; FET	
2	Aquaculture Production	GET, FET & HE	N	SC; Dip; Deg	SC; Deg	L	H	Univ; Private; DEA; DAFF; FET	
Coastal Agriculture & Forestry									
1	Coastal Agriculture & Forestry	GET, FET & HE	L	SC; Dip; Deg	N	L	M	Univ; Private; DEA; DAFF; FET	

Climate Research									
1	Global Climate Change	GET, FET & HE	N	SC; Dip; Deg	SC; Deg	L	H	Univ; Private; DEA; DAFF; FET	
Environmental Education Human Health									
1	Environmental Education	GET, FET & HE	N	SC; Dip; Deg	SC; Dip; Deg	M	H	Univ; Private; DEA; DAFF; FET	
2	Health & Safety	GET, FET & HE	N	SC; Dip; Deg	SC; Dip; Deg	H	H	Univ; Private; DEA; DAFF; FET	
3	Eco tourism	GET, FET & HE	L	SC; Dip; Deg	SC; Dip; Deg	M	H	Univ; Private; DEA; DAFF	
4	Public Relations	GET, FET & HE	M	SC; Dip; Deg	SC; Dip; Deg M	M	H	Univ; Private; DEA; DAFF	
Training of inspectors									
1	Fisheries Monitoring, Control & Surveillance (MCS)	GET, FET & HE	N	SC; Dip; Deg	N	L	H	Univ; Private; DEA; DAFF; FET	
2	Environmental Management (Environmental inspectors)	GET, FET & HE	N	SC; Dip; Deg	SC; Dip; Deg	M	H	Univ; Private; DEA; DAFF; FET	

Trans-disciplinary training of managers									
1	Ecosystems approach training	HE	N	SC; Dip;Deg	SC	M	H	Univ; Private; DEA; DAFF; FET	
Biodiversity									
1	Biodiversity	GET, FET & HE	N	SC; Dip; Deg	Dip; Deg	L	H	Univ; Private; DEA; DAFF; FET	
Taxonomy & Curation									
1	Taxonomy	GET, FET & HE	N	SC; Dip;Deg	Dip; Deg	L	H	Univ; Private; DEA; DAFF; FET	
2	Curation	GET, FET & HE	N	SC; Dip; Deg	Dip; Deg	L	H	Univ; Private; DEA; DAFF; FET	
Pollution									
1	Marine Pollution Monitoring	GET, FET & HE	N	SC; Dip; Deg	SC; Dip; Deg	L	H	Univ; Private; DEA; DAFF; FET	
2	Ecotoxicology	GET, FET & HE	N	SC; Dip; Deg	Dip; Deg	L	H	Univ; Private; DEA; DAFF; FET	
Environmental Impact Assessment (EIA)									
1	EIA	GET, FET & HE	N	SC; Dip; Deg	SC; Dip; Deg	M	H	Univ; Private; DEA; DAFF; FET	

5. Regional and International linkages and support

This section indicates the linkages and support (regional and international) within the Marine Sector of SA and is divided in:

1. Climate and Atmosphere

Air Quality - Southern Africa Environment

Project http://www.oneworld.org/saep/subject/air_climate/air.html

Press releases, articles and links to related air quality, climate change, El Nino, and desertification sites.

The Air Quality Information System (AQIS)

<http://www.csir.co.za/environmentek/aqis/index.html>

Supports Integrated Environmental Management (IEM) projects involving atmospheric pollutants. Focuses on air quality. Useful and difficult to find information on industrial and vehicle emissions, the impact of specific emissions, sources of air pollution data, and meteorological information for atmospheric modelling.

CICERO - Center for International Climate and Environmental Research -

Oslo <http://www.cicero.uio.no/eindex.html> Focuses on air pollution, climate change and energy production, decision analysis tools, and climate change in Africa. Abstracts of publications, links to related sites, newsletters and magazines, and information databases.

Climate Change - Southern Africa Environment

Project http://www.oneworld.org/saep/subject/air_climate/climate_change/climate.html News, articles and links to climate change, desertification, and air quality.

Climate Change Secretariat

<http://www.unfccc.org/> Includes country information about South Africa, data on inventories of emissions, and publications.

Climate System Analysis Group (CSAG) - University of Cape Town

<http://www.egs.uct.ac.za/csag/> Forecasting, satellite images, stations data, research.

Department of Minerals and Energy - Energy Branch

<http://www.dme.gov.za/> Information on energy and alternative energy. Policy document, consumption figures for use of paraffin, petrol and diesel, sectoral consumption figures of energy.

Department of Transport

<http://www.transport.gov.za/> Project information, including Spatial Development Initiatives (SDIs), policy documents, and legislation.

Energy and Development Research Centre (EDRC)

<http://www.edg.co.za/> Includes the National Domestic Energy Use Database containing information on energy use in households; publications; online documents; and links to other energy sites.

Environment - Southern Africa Environment

Project <http://www.oneworld.org/saep/subject/energy/energy.html> News, articles, policy documents and energy links.

Energy Research Institute (ERI), University of Cape Town

<http://www.eri.uct.ac.za/eri.html> Selected energy statistics, publications and a list of reports.

NOAA Climate Prediction Center - African

Desk http://nic.fb4.noaa.gov/products/african_desk/index.html Station data, rainfall outlooks, rainfall maps.

South Africa Government Online

<http://www.gov.za/> Official government site. Government information, including local and provincial governments. Documents, reports and forms, SA Yearbook 1998, and links.

South African Government of National Unity

<http://www.polity.org.za/gnuindex.html> Links to government sites, documents, legislation and other Internet resources.

2. Coastal and Marine Ecosystems

Coastal Management Policy Programme - (CMPP)

<http://www.cmpp.co.za/> Programme information, key findings, policy papers on coastal management, news items, full-text version of the newsletter "Our Coast", and links to related sites.

Coastal Zone Management - Southern Africa Environment

Projecthttp://www.oneworld.org/saep/subject/coastal_marine/coastal.html News, policy documents, articles and links to coastal zone management and marine resources.

Sea Fisheries - Department of Environmental Affairs and

Tourism<http://www.gov.za/sfri/index.html> Research information, policy documents, news. South Africa

3. Other

Convention on International Trade in Endangered Species (CITES)

<http://www.unep.ch/cites.html>

Convention on Biological Diversity

<http://www.biodiv.org/>

Convention on Migratory Species

<http://www.wcmc.org.uk/cms/>

Convention on Biodiversity - Clearing-House Mechanism

<http://www.biodiv.org/chm/>

World Heritage Convention

<http://www.unesco.org/whc/welcome.htm>

Convention to Combat Desertification

<http://www.unccd.ch/>

United Nations Environment Programme

<http://www.unep.org/>

South African Weather Bureau - Climatology

Directorate <http://www.sawb.gov.za/www/climate/index.htm> Daily climate summaries, rainfall maps, average climatological values, and publications.

Government Online

<http://www.gov.za/> Government information, including local and provincial governments. Documents, reports and forms, SA Yearbook 1998, and links.

South African Data Centre for Oceanography

(SADCO)<http://fred.csir.co.za/ematek/sadco/sadco.html> A database for multi-disciplinary marine information from the areas around southern Africa.

South African Government of National Unity

<http://www.polity.org.za/gnuindex.html> Links to government departments, policy documents, legislation.

IUCN - World Conservation Union

<http://www.iucn.org>

WWF International

<http://www.wwf.org/>

Department of Agriculture

<http://www.agric.za/>

Department of Water Affairs and Forestry

<http://www-dwaf.pwv.gov.za/idwaf>

South African National Parks

<http://www.parks-sa.co.za/>

KwaZulu-Natal Nature Conservation Service

<http://www.wildnetafrica.com/kwazulunatalparks/index.html>

Coastal Management Policy Programme

<http://www.cmpp.co.za/>

Birdlife South Africa

<http://www.birdlife.org.za/>

Water Research Commission

<http://www.oneworld.org/saep/subject/wetlands/wetlands.html>

Foundation for Research Development

<http://www.frd.ac.za/>

Council for Scientific and Industrial Research

<http://www.csir.co.za/environmentek/index.html>

Council for Geoscience

<http://www.geoscience.org.za/>

Institute for Water Research

<http://www.ru.ac.za./departments/iwr/iwr.html>

Department of Ichthyology and Fisheries Science

<http://www.ru.ac.za./academic/departments/difs/>

Institute of Natural Resources

http://www.unp.ac.za/MP/research_report/ar_inst.htm#3

Institute for Coastal Resources

<http://www.upe.ac.za/icr/default.htm>

Centre for Environmental Management

<http://www.uovs.ac.za/nat/zent/sob/>

South African Museum

<http://nv1.samuseum.ac.za>

World Conservation Monitoring Centre

<http://www.wcmc.org.uk/>

Brief explanation of the South African Legislative Process

<http://www.polity.org.za/govdocs/legislation/process.html>

Information on South Africa

<http://www.sinc.sunysb.edu/Stu/hjlee>

6. Proposed start-up training projects and activities

The following section will be subdivided into the following categories:

- Motivation (in the context of ecosystem management)
- Type of training required
- Training methods
- Work plan
- Budget estimates

Motivation

The strategy proposed in this document is based on the model proposed and used in the BENEFIT programme (and the subsequent BCC programme). Although claiming to be highly successful, it has yet to be ascertained to what extent success can be claimed. The training projects proposed here comprises of 2 elements:

- HE training
- GET & FET training

The strategy presented in this document makes the following assumptions:

- T&CB activities in this project are designed to target as much of the marine sector / spectrum of South Africa as well as those contributing to the marine sector management (i.e. not only managers, scientists and technicians, but more so users of the marine environment). It therefore targets also the user groups (public sector, government departments and the private sector).
- The T&CB interventions will be limited to providing a framework for T&CB and will preclude financial support for human resources (salaries), bursaries for formal studies and major infrastructural requirements.
- Hence the bulk of interventions will be to co-ordinate T&CB activities in South Africa and to propose courses and activities targeting the needs of particular sectors.

The premise of the strategy is that previous efforts for T&CB have focussed on the formal education sector (HE). South Africa has need of dedicated effort to co-ordinate education in the informal education (GET & FET) for the marine sector. The strategy proposed for the ASCLME diverges from that of BCC and focuses on developing a framework for the informal education sector (GET & FET).

An Agriseta project initiated in the Western Cape has proposed that a focussed effort be made to look at the informal education sector in that province. The AISA conducted a preliminary survey where all the Western Cape farms that were interviewed, irrespective of the size of the farms (i.t.o volume and personnel), indicated and emphasized the need for basic on-farm short course training (in the “local” language) at the **unskilled level** (and even semi-skilled and skilled level) that will include a basic introduction into aquaculture, basic business principles, basic finance management and very importantly basic life skills principles.

Certain areas on the West Coast (such as Saldanha Bay) have a great need for courses being presented in Xhosa, whereas areas in Stellenbosch/Franschhoek and surroundings prefer Afrikaans and areas on the South Coast require courses in English, Afrikaans and Xhosa. In the Knysna area Xhosa would be

the preferred language. Farmers emphasised the importance of training “locally” (on-farm or in the area) and added that although distance (satellite) courses are available, it is more on the level of a grade 12 (St. 10) pupil and does not cater for the absolute basics on the level of the unskilled and semi-skilled workers.

The farmers indicated that the “absolute basics” referred to above should include topics like:

- communication with co-worker and management,
- hygiene at work,
- personal hygiene,
- confidence building,
- dealing with conflict/criticism,
- conducting meetings,
- setting goals,
- problem solving,
- importance of work attitude/body language/dress code,
- basic telephone skills,
- understanding cultural differences,
- coping with alcohol abuse/child molesting/drug abuse/HIV & aids,
- office etiquette,
- time management,
- day planning and prioritization,
- understanding what is expected of me and how that relates to the rest of the company and even the customer etc.

As far as semi-skilled and skilled levels, short courses with similar content as the above but taken to the next level and including more technical issues such as:

- Management and leadership skills,
- handling power,
- taking responsibility,
- record keeping/traceability,
- accepting authority,
- stock movement,
- correct documentation,
- receiving and dispatching,
- inter-departmental communication,
- meeting customer expectations,
- decision making,
- staff recruitment,
- chairing of meetings,
- being on time,
- team building,
- understanding the biology of the animal,
- writing of reports/motivations,
- budgeting and other business and financial management skills,
- first aid,
- water quality,
- animal biology,
- animal health and handling,
- tank holding system management,
- processing,

- transport and collecting,
- order preparation,
- sales follow-up,
- export issues,
- environmental impact awareness,
- grading culling,
- fry rearing,
- culling,
- fish nutrition,
- feeding and
- management etc.

As far as senior management levels, short courses similar to the above but with the aim to give introduction to Aquaculture to the already qualified Finance Manager or Marketing Manager are necessary. Most of the bigger companies indicated that their top management is well qualified and that they recruit University graduates that obtained degrees in fields such as Agriculture (with Aquaculture as main subject), Marine Biology, Oceanography, Marketing, M.BA etc. They have expressed the difficulty of bridging the gap from semi-skilled to management and said unless we address this barrier it will get increasingly difficult to move those candidates into management and therefore delaying broad based black economic empowerment (BB BEE).

They emphasised that currently the gap is too big and instead of empowering their staff, they disempowered the staff by placing the candidates in positions where the candidates are unable to deliver on the performance agreements specific to management level. However, some of the emerging, small and medium farmers indicated that their middle and even senior management candidates are unskilled, semi-skilled or skilled.

There is therefore a significant need for training in

- entrepreneurial skills,
- business skills and
- managerial skills on

The most important factor that was pointed out by all the interviewees, was the importance of on-farm (or in close vicinity of the farm) accredited short courses that can contribute as credits toward more formal training which will assist with bridging the gap referred to above. It is proposed that the suggestions be considered for the ASCLME project.

Processors:

Training needs in trout processing is similar to what's outlined above, however they indicated that having an overseas expert brought to South Africa to work in the processing plant (for a week or so) with the workers, explaining processing techniques such as filleting, de-boning, slicing etc., would together with Hazard Analysis and Critical Control Points (HACCP) training/Export training bring incredible value and compliment the short courses referred to above.

Feed manufacturers: Approximately 60 - 80% of a farmer's on-farm production costs involve purchasing feed. If feed is incorrectly stored or fed to animals, it can very well be the end of the aquaculture farm. If, however, applied and stored correctly it can save the farmer up to 20% of his/her capital expenses. The need for a feed management course to farmers that would provide training on feed application and feed storing was highly recommended. This will compliment the virtual automated computer feed management package (which is desperately in need of financial support and human capacity to write components/procedures) that they are busy designing to assist unskilled farmers with feed management. In terms of their own capacity building and training, they are closely

related to the University of Stellenbosch (US) and since it is such a highly skilled area, they secure students and personnel directly from the University.

The above explanation and motivation moves away from formal education and places emphasis on the informal education sector. It further diverges from the T&CB proposed by the BCC in that it should not provide short courses to supplement graduates, but rather focus on the informal education sector (GET & FET).

Type of training required

The type of training required in South Africa focuses on an attempt to address the vast skills void prevalent in most coastal communities. To meet these needs it is herewith proposed a two-tier approach to the types of training required:

1. Short course development for the HE sector
2. Short course development for the GET & FET sector.

Focus on the second band of training is proposed here.

Short course development for the HE sector

The evolution of the HEQF has resulted in the need to address skills development and hands-on approaches to these. The Higher Education Act (2007) addresses the need for outcomes learning and all HE institutions will be obliged to conform to the Act within the next 5 years. The training in HE for the marine sector will be addressed by the changes in the Higher Education framework and institutions will be encouraged to re-look at competencies of graduates. It is therefore proposed that all HE institutions agree on competencies needed for the marine sector and that these be effected in co-ordinated manner. It is proposed that this happens via the SANCOR (MCEN).

Skills development needed in the HE is outside mainstream degrees and diplomas. As an example, although the focus of science degrees should be science, when graduates start employment, certain business and human resources skills are lacking. It is therefore proposed that such competencies be supplemented to graduates once that complete their first degree. The supplementary courses will add to skills development in South Africa. Furthermore such courses should be concise and at the appropriate NQF level (it is not suggested that NQF level 6 human resources be done for Science graduates, a level 5 should suffice). It is proposed that the short course be taken from the SETA's.

To affect the short course development and training plan for the HE sector, it is proposed that a national HE short course audit be done and that a co-ordinating institute be mandated to carry out the necessary training. As a point of departure, it is proposed that the courses proposed by BCC be considered for South Africa and that it be done in consultation with the BCC (see Table 4).

Table 4: Prioritized list of courses showing the level, mode of delivery and potential service providers for the SAP-IMP / BCC project. Table amended to apply to South Africa only. (Source: BCC).

Topic	Level	Mode / Delivery/	Potential Service Providers
Ecosystem Management			
1	Environmental Impact Assessment and review	GET; FET; HE	Lectures and field work, local case studies SAEIA RU

2	Aquaculture Management	GET; FET; HE	Lectures, field & practical	SUN RU
3	Resource Economics	GET; FET; HE	Lecture using local case studies and fisheries sectors	UCT UWC
4	Environmental Law	GET; FET; HE	Lectures and case studies	UCT IOI-SA
5	Pollution monitoring	GET; FET; HE	Lectures, field trips and practical exercise	WIO-Lab IOI-SA GloBallast / NPA SA CSIR CPUT
6	Ecosystem (Transboundary) Based Fisheries Management	GET; FET; HE	Lectures and simulated computer modeling (understanding models)	UCT MCM WWF
7	Coastal Zone Management	GET; FET; HE	Lectures	UWC UCT NMMU WWF RU
8	Policy Development	FET; HE	Lectures with case studies	UWC UCT IOI – SA
Numerical Skills				
9	Stock Assessment	FET; HE	Computer modeling using case studies and local examples, incorporating the disassembly of previous conducted stock assessments	RU UCT OLRAC

10	Acoustic methods	GET; FET; HE	Lectures & on board practical dovetailed with acoustic software training	IOW IMR SonarData
11	Ecological modeling and decision analyses for EAF	FET; HE		UCT M&CM
12	Data analysis & experimental design techniques	GET; FET; HE	Lecture, with examples using local data	UCT ODINAFRICA SAEON IOI-SA CSIR
13	GIS and Mapping	GET; FET; HE	Practical examples using biological data (local data if possible)	UCT RU NMMU CPUT
Biology, Taxonomy & Ecology				
14	Fish ageing and histology	GET; FET; HE	Workshop/Lecture type training	M&CM RU
15	Plankton identification	GET; FET; HE	Workshop/Lecture type training including verification and validation sampling and id methods	M&CM UWC UCT
16	Aquaculture husbandry and health	GET; FET; HE	Lectures and hands-on field work at established farms	SUN RU
17	Invertebrate taxonomy	GET; FET; HE	Lectures and microscopy identification and classification methods	UWC IOI-SA
18	Invasive species management	GET; FET; HE	Formal lectures & site visits	GloBallast

Computer Skills and Data Management				
19	Data duration	GET; FET; HE	Data basing, archiving, extraction etc, using local data collections	ODINAFRICA SAEON GOOS
20	Vessel Monitoring Systems	GET; FET; HE	Instrumentation use, maintenance & calibration	M&CM Suppliers
Technical Skills				
21	Survey techniques & instrument deployment	GET; FET; HE	Shipboard	M&CM IMT UCT
22	Scientific Diving	Class 4	Lectures and practical training	Diving Unit at UCT
23	Instrumentation maintenance & calibration	GET; FET; HE	Lecture interspersed with hand-on training (including one day calibration on board a vessel)	M&CM CSIR IMT
24	Water quality monitoring	GET; FET; HE	Lectures and practical training	CSIR M&CM CPUT
Social & Economic Sciences				
25	Public Relations	GET; FET; HE	Standard course	Private providers EcoAfrica
26	Co-management with coastal communities	GET; FET; HE	Lectures using local case studies	UCT UWC IOI – SA NMMU

				C.A.P.E WIOMSA EcoAfrica WWF
Physical Oceanography				
27	Application of Remote Sensing data	GET; FET; HE	Lectures and practical applications	UCT M&CM SAEON
Cross Cutting				
28	Communication Skills	GET; FET; HE	Theory & Practice	Private Provider CPUT
29	English Training	GET; FET; HE	Lectures	CPUT Private Provider
30	Project Management	GET; FET; HE	Lectures with simulated examples	CPUT UCT IOI-SA Private Provider
31	Life Skills	GET; FET; HE	Interactive lectures followed by inter-sessional discussions	UCT CPUT Private Provider
32	Library Skills	GET; FET; HE	Lectures & practical exercises on site	M&CM Private Provider CPUT ODINAFRICA
33	Mentoring tutorship	GET; FET; HE	Interactive lectures and groups	CPUT IOI-SA Private Provider

Short course development for the GET & FET sector

The greater challenge for T&CB in South Africa is to develop a SAP for the GET & FET sector. This sector has been ignored in previous attempts to address shortcomings and it is purported to have the greatest need. The greatest challenge lies in defining the various sectors of the marine sector. Only once this has been defined and contextualised, can a skills audit be done. Once a skills audit is done, it is proposed that a T&CB framework be developed and implemented. This requires a co-ordinated effort and it is proposed that a National GET & FET marine training co-ordinator (or institute / consultancy) be appointed for short period (5-7years) to develop a national GET & FET marine education framework. The appointment should be to facilitate a national directive based on national marine sector needs.

The same approach as the HE short course development is proposed.

It is proposed the marine sector adopt:

1. An Ecosystems Approach to Fisheries Management in their Skills Development Plan, by offering basic courses on these (see WWF training section 3.2.4.6 and 4.10)
2. Environmental Management Systems to reduce carbon footprints and adopt “green” strategies, systems and technologies accordingly. (This also applies to NGO, government and institutes).

As a point of departure, it is recommended that the short courses listed in Table 3 and Table 4 be considered for the GET & FET levels of T&CB.

Training methods

It is suggested that training methods:

1. Be in short course formats (one to few days). These short courses could contribute towards qualifications
2. Be offered in the home language of the persons involved
3. Be learner focussed
4. Comprise a combination of lectures, practical's (field or site visits/) and case studies (eg in own company/institutes)
5. Have a web presence where possible and applicable.

Work plan

Table 5. Proposed action/workplan

Action	2010												2011											
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D						
Appoint Co-ordinator to develop GET, FET & HE T&CB Plan																								
Development of T&CB Plan (GET, FET & HE)																								
Develop Framework for GET & FET T&CB																								
Develop Framework for HE T&CB																								
Develop Learning Material (all sectors)																								
Train the trainers (Nationally)																								
GET T&CB training																								
FET T&CB training																								
HE T&CB training																								
Reflection on training activities and consultation with sectors																								
Implement change management																								

Action	2012												2013											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Appoint Co-ordinator to develop GET, FET & HE T&CB Plan																								
Development of T&CB Plan (GET, FET & HE)																								
Develop Framework for GET & FET T&CB																								
Develop Framework for HE T&CB																								
Develop Learning Material (all sectors)																								
Train the trainers (Nationally)																								

GET T&CB training		
FET T&CB training		
HE T&CB training		
Reflection on training activities and consultation with sectors		
Implement change management		

	2014	2015
Action	J F M A M J J A S O N D	J F M A M J
Appoint Co-ordinator to develop GET, FET & HE T&CB Plan		
Development of T&CB Plan (GET, FET & HE)		
Develop Framework for GET & FET T&CB		
Develop Framework for HE T&CB		
Develop Learning Material (all sectors)		
Train the trainers (Nationally)		
GET T&CB training		
FET T&CB training		
HE T&CB training		
Reflection on training activities and consultation with sectors		
Implement change management		

Budget estimates

Table 6. Budget estimates for proposed action plan

Action	2011	2012	2013	2014	2015	Total
Appoint Co-ordinator to develop GET, FET & HE T&CB Plan	R 500,000	R 500,000	R 500,000	R 500,000	R 200,000	R 2,220,000
Development of T&CB Plan (GET, FET & HE)	R 30,000					R 50,000
Develop Framework for GET & FET T&CB	R 50,000					R 50,000
Develop Framework for HE T&CB	R 30,000					R 30,000
Develop Learning Material (all sectors)	R 300,000	R 400,000				R 700,000
Train the trainers (Nationally)	R 40,000	R 300,000				R 340,000
GET T&CB training		R 160,000	R 240,000	R 240,000	R 120,000	R 760,000
FET T&CB training		R 160,000	R 240,000	R 240,000	R 120,000	R 760,000
HE T&CB training		R 160,000	R 240,000	R 240,000	R 120,000	R 760,000
Reflection on training activities and consultation with sectors			R 30,000	R 30,000	R 30,000	R 90,000
Implement change management			R 50,000	R 50,000		R 100,000
Total	R 950,000	R 1,680,000	R 1,300,000	R 1,300,000	R 590,000	R 5,820,000

7. Acknowledgements

All who were approached for information.

8. Bibliography

1919. Public Health Act, 1919 1935. The Sea-Shore Act, 1935 1951. Merchant Shipping Act, 1951 1973. Sea Birds and Seals Protection Act, 1973, Government Gazette No. 3909, Cape Town, pp.14. 1980.

Dumping at Sea Control Act, 1980, Government Gazette No.7061, Cape Town, pp. 15. 1981. Marine Traffic Act, 1981, Government Gazette No. 7408, Cape Town pp.10. 1981.

Prevention and Combating of Pollution of the Sea by Oil Act, 1981, Government Gazette No. 7427,

Cape Town pp. 40. 1981. South African Transport Services Act 1981 1986. International Convention for the Prevention of Pollution from Ships Act, 1986, Government Gazette No. 10126, Cape Town pp. 53. 1987. International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties Act, 1987, Government Gazette No.10937, Cape Town, pp.14. 1989. The Environment Conservation Act, 1989, Government Gazette No. 11927, Cape Town, pp.34. 1991. Minerals Act, 1991 1994. Maritime Zones Act, 1994 1995. The Development Facilitation Act, 1995 1996. The Constitution of the Republic of South Africa 1996 1996. Wreck and Salvage Act, 1996, President's Office No. 1893 pp. 23. 1997. Water Services Act: <http://www.iucnrosa.org.zw/elisa/environmental> 1998. Marine Living Resources Act, 1998 1998. National

Environmental Management Act, 1998, Government Gazette No. 19519, Cape Town, pp.73. 1998. National Water Act, 1998 1998. South African Marine Safety Authority Act, 1998 2000. White Paper for Sustainable Coastal Development in South Africa 2000 2000. White Paper on Integrated Pollution Waste management for South Africa, A Policy on pollution prevention, Waste minimisation, impact management and remediation, Government Notice No. 20978, pp. 78. 2002. Disaster Management Act, 2002 2002. Mineral and Petroleum Resources Development Act, 2002, Government Gazette No. 23922, Cape Town, pp.62.

BCLME Capacity and Needs Assessment – Draft Report, December 2003
171Anon. 2003. Cape Metropolitan Coastal Water Quality Committee Annual Report Anon 2003. Department of Environmental Affairs and Tourism: Business Plan 2003-2004, Programme 3: Marine and Coastal Management, pp. 79-93. Anon 2003. Department of Environmental Affairs and Tourism: Strategic Plan 2003 – 2006, pp. 7–47. Anon 2003. Summary of EVAG Workplan – Revised Workplan. BCLME Programme, internal document, pp. 4. Brown, A. C. 1987. Marine pollution and health in South Africa. S.A. Medical Journal, Vol 71, pp. 244 – 248. Census South Africa 2001, Statistics SA Clark, B. M., Meyer, W. F., Ewart-Smith, C, Pulfrich, A and Hughes, J. 1999. Synthesis and assessment of information on the BCLME Thematic Report 3: Integrated overview of diamond mining in the Benguela Current Region, pp. 63.

Sherman, K. & Duda, A.M. 1999 An ecosystem approach to global assessment and management of coastal waters. *Marine Ecology Progress Series*, vol. 190:271-287

Anon 2001d. Training Institutes in the SADC Region, pp. 34.

Intergovernmental Oceanographic Commission, Principles for the Global Ocean Observing System (GOOS) Capacity Building, UNESCO 2001. GOOS Report No. 69. IOC/INF-1158

Cicin-Sain, B. editor-in-chief and Chua, T.E., Yáñez-arancibia A. and Vallega A. associated editors 2002 *Ocean and Coastal Management*, Special Issue. Capacity building – papers from the Global conference on Oceans and Coasts at Rio+10. vol. 45

[Clark, B., Laros, M.T & Atkinson L.J. 2004 Training and Capacity Needs Assessment for the BCLME. Anchor Environmental Consultants Cc. 184pp](#)

[Anon 2004a Report on the](#) Consultative meeting on capacity building and training for effective management of the Benguela current large marine ecosystem (BCLME) 15th-16th March 2004, Safari Hotel, Windhoek, Namibia

[Anon 2005 Report on](#) Strategic workshop on training needs and capacity building for effective, integrated and sustainable management of the Benguela Current Large Marine Ecosystem. Johannesburg, South Africa

Anon 2005a The Project Ev/03/05 "Built Capacity for Angola" Inventory of existing laboratorial capacity in Angola: Space, Equipment, and Type Of Analyses That Can Be Performed

Anon 2005b Project ev/03/05 "Built capacity for Angola" evaluation of technical Capacity in terms of numbers of researchers/technicians, degree of expertise (Formal qualifications plus experience with particular analytical techniques and identify deficiencies or gaps which need to be filled in order to meet the countries requirements.

Anon 2005c Project ev/03/05 "Built capacity for Angola" Proposal of a course of action or recommendations to fill gaps and deficiencies, in terms of numbers, training and equipment of techniques.

Anon 2005 Project Document: Bridging Benefit in Preparation for the Interim Benguela Commission. Project of the Norwegian Embassy in Pretoria, South Africa in conjunction with the BENEFIT Management Action Committee.

Clark, B & Duffel-Canham, A. 2006 Integration And Review Of Training And Capacity Building In The BCLME Programme, 42pp

APPENDIX 1

CONTACT ADDRESSES OF TERTIARY INSTITUTIONS

<p>Nelson Mandela Metropolitan University PO Box 77000, Port Elizabeth, 6031 Campus Switchboards: Missionvale: 27-41-408-3111 2nd Avenue: 27-41-504-3911 Bird Street: 27-41-504-4000 North Summerstrand: 27-41-504-1111 South Summerstrand : 27-41-504-2111 Saasveld: 27-44-801-5111 York Stret: 27-44-874-2801 E-mail: info@nmmu.ac.za URL: http://www.nmmu.ac.za/</p>	<p>Cape Peninsula University of Technology PO Box 652, Cape Town 8000 Tel: (021) 959-6121, Fax: (021) 460-3698 E-mail: info@cput.ac.za URL: http://www.ctech.ac.za/</p>
<p>North-West University Private Bag X6001, Potchefstroom, 2520 Tel: (018) 299-1111, Fax: (018) 299-2799 E-mail: enquiries@nwu.ac.za URL: http://www.nwu.ac.za/</p>	<p>North-West University (Mafikeng Campus) Private Bag X2046, Mmabatho, 2735 Tel: 27-18-389-2111, Fax: 27-18-392-5775 E-mail: Lester.Mpolokeng@nwu.ac.za URL: http://www.nwu.ac.za/</p>
<p>North-West University (Vaal Triangle Campus) P.O. Box 1174, Vanderbijlpark, 1900 Tel: 27-16-910-3111, Fax: 27-16-910-3116 E-mail: Elbie.Steyn@nwu.ac.za URL: http://www.nwu.ac.za/</p>	<p>Rhodes University P.O. Box 94, Grahamstown, 6140 Tel: 27-46-603-8111, Fax: 27-46-622-5049 E-mail: registrar@ru.ac.za URL: http://www.ru.ac.za/</p>
<p>University of Cape Town The Registrar, University Private Bag X3, Rondebosch 7701 Tel: (021) 650-9111, Fax: (021) 650-</p>	<p>University of Johannesburg PO Box 524, Auckland Park, 2006 South Africa Tel: (0)11 559-2911, Fax: (0)11 559-2191</p>

<p>5667 URL: http://www.uct.ac.za/</p>	<p>E-mail: myFuture@uj.ac.za URL: http://www.uj.ac.za</p>
<p>University of KwaZulu-Natal (Westville) Private Bag X 54001, Durban, 4000 Tel: 27-31-260-1111, Fax: 27-31-260-7638 E-mail: enquiries@ukzn.ac.za URL: http://www.ukzn.ac.za/</p>	<p>University of KwaZulu-Natal (Edgewood) Private Bag X03, Ashwood, 3605 Tel: 27-31-260-1111, Fax: 27-31-260-7638 E-mail: education@ukzn.ac.za URL: http://www.ukzn.ac.za/</p>
<p>University of KwaZulu-Natal (Howard College) King George V Avenue, Glenwood, Durban, 4041 Tel: 27-31-260-1111, Fax: 27-31-260-1274 E-mail: enquiries@ukzn.ac.za URL: http://www.ukzn.ac.za/</p>	<p>University of KwaZulu-Natal (Pietermaritzburg) Private Bag X01, Scottsville, Pietermaritzburg, 3209 Tel: 27-31-260-1111, Fax: 27-33-260-5729 E-mail: enquiries@ukzn.ac.za URL: http://www.ukzn.ac.za/</p>
<p>University of Pretoria Pretoria 0002, Tel: (012) 420-3111, Fax: (012) 420-4555 E-mail: csc@up.ac.za URL: http://www.up.ac.za/</p>	<p>University of South Africa PO Box 392, Pretoria 0003 Tel: 27-11-670-9000, Fax: 27-12-429-2565 E-mail: study-info@unisa.ac.za URL: http://www.unisa.ac.za/</p>
<p>University of Stellenbosch The Registrar, Private Bag X1, Matieland 7602 Tel: (021) 808-9111, Fax: (021) 808-4499 E-mail: usbritz@sun.ac.za URL: http://www.sun.ac.za/</p>	<p>University of the Western Cape Private Bag X17, Bellville 7535 Tel: (021) 959-3900, Fax:(021) 951-3627 E-mail: abjoseph@uwc.ac.za URL: http://www.uwc.ac.za</p>
<p>University of the Witwatersrand Private Bag 3, WITS, 2050 Tel: (011) 717-1000, Fax: (011) 717-1065 E-mail: studysa@international.wits.ac.za -</p>	

URL: <http://www.wits.ac.za/>

APPENDIX 2

CONTACT ADDRESSES OF national fisheries in South Africa

	NAME	WEBSITE	CONTACT NUMBER
1	South African Institute for Aquatic Biodiversity	http://saiab.ru.ac.za/infoportal/	+27 46 603-5841 or +27 46 603-5841
2	Council for Scientific and Industrial Research	http://www.csir.co.za/SAC/index.html	+27 12 334 5058 or +27 12 334 5058
3	South African Biodiversity Information Facility	http://www.sabif.ac.za	+27 21 799 8698/9 or +27 21 799 8698/9
4	Southern African Data Centre for Oceanography	http://sadco.csir.co.za/	+27 21 888-2520 or +27 21 888-2520
5	South Africa. Department of Water Affairs and Forestry. Water Services National Information System	http://www.dwaf.gov.za/	+ 27 12 336 8041 or +27 12 336 8041
6	South African National Biodiversity Institute	http://www.sanbi.org/	+27 21 799-8800 or +27 21 799-8800

APPENDIX 3

ACRONYMS

BCLME	Benguela Current Large Marine Ecosystem (Programme)
BENEFIT	BENguela Environment Fisheries Interaction & Training (Programme)
BEP	Benguela Ecology Programme
CCAMLR	Convention for the Conservation of Antarctic Marine Living Resources
CSIR	Council for Scientific and Industrial Research (South Africa)
CSP	Commercial Sampling Programme (Namibia)
DIFS	Department of Ichthyology and Fisheries Science (Rhodes University)
ENVIFISH	Environmental Conditions and Fluctuations in Distribution of Small Pelagic Fish Stocks (Programme)
EU	European Union
FAO	(United Nations) Food and Agriculture Organisation
FIOC	Fisheries Inspector and Observer Course (Namibia)
FIRI	Fishing Industry Research Institute (Cape Town)
GEF	Global Environmental Facility (United Nations)
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HACCP	Hazard Analysis Critical Control Points
ICEIDA	Icelandic International Development Agency
IIP	Instituto de Investigação Pesqueira (Angola)
IPA	Instituto de Desenvolvimento da Pesca Artesanal (Angola)
IMR	Institute of Marine Research (Bergen, Norway)
IRD	Research Institute for Development (France)
JLBSII	JLB Smith Institute of Ichthyology
LME	Large Marine Ecosystem
MARAM	Marine Resource Assessment and Management Group (UCT)
MCM	(Chief Directorate of) Marine and Coastal Management (South Africa)
MFMR	Ministry of Fisheries and Marine Resources (Namibia)
MCS	Monitoring, Surveillance and Control (Unit)(South Africa)
NAMFI	Namibia Maritime and Fisheries Institute

NatMIRC	National Marine Information and Research Centre (Namibia)
NORAD	Norwegian Agency for Development Co-operation
OTD	Oceanographic Technicians Diploma (Cape Technikon)
PON	Polytechnic of Namibia
SADC	Southern African Development Community
SAC	Satellite Applications Centre (CSIR, South Africa)
SAQUA	South African Educational Authority
SEAFO	South East Atlantic Fisheries Organisation
SFRI	Sea Fisheries Research Institute (South Africa)
SST	Sea-surface temperature
UCT	University of Cape Town
UNAM	University of Namibia
UPE	University of Port Elizabeth
UWC	University of the Western Cape

APPENDIX 4

LIST OF WEBSITES VISIT

<http://www.dlist-benguela.org>.

<http://www.nacoma.org.na>

<http://www.norway.org.za/development/bilateral/Fisheries/Marine+Fisheries+Co-operation.htm>.

<http://www.gtz.de>

<http://www.capeaction.org.za/>

<http://www.odinafrica.org/>

<http://www.gbif.org>

<http://www.ioc-goos.org>

<http://www.start.org/>

<http://www.scor-int.org>

<http://www.sadc.int>

<http://www.nepadcosmar.org>

<http://www.icsu.org>

http://www.fao.org/waicent/portal/virtualibrary_en.asp <http://www.imber.info/index.html>

<http://www.globallast.imo.org/index>

<http://www.ur097.ird.fr/index.htm>

<http://acep.co.za>

<http://www.wiomsa.org>

<http://www.wiolab.org>

<http://www.saeon.ac.za>

<http://www.sida.se>

<http://www.botany.uwc.ac.za/sancor>

