

COURSE REPORT

Training Workshop on Marine and Coastal Environmental Monitoring Methods

15-17 February 2009
Dubai, UAE



Special Report 2.1- 4

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UNU-INWEH
March 2009



UNITED NATIONS
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جامعة زايد
ZAYED UNIVERSITY

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I. INTRODUCTION

Rationale of the course

UNU's International Network on Water, Environment and Health (UNU-INWEH), with support from the United Nations Environment Programme (UNEP) and Zayed University, held a Training Workshop on Marine Environmental Monitoring Methods from 15-17 February 2009 at Zayed University, Dubai, United Arab Emirates. This workshop was a capacity development effort offered as part of UNU-INWEH's project "Strategic Management of Marine Ecosystems in Nakheel Projects" which aims to ensure long-term sustainability of off-shore coastal developments through a focused research and monitoring program.

This training workshop is part of an on-going effort to build capacity for coastal marine environmental management in the Persian Gulf region, and was aimed at the larger community of coastal-zone practitioners (scientists, NGOs and government policy makers). The first training workshop was held from 20-23 January 2008 at the same venue, and focused on Environmental Impact Assessments (EIA). This was a specific need identified in this area because coastal development is occurring on a large scale and fast pace.

The theme of the second training workshop was Marine Environmental Monitoring Methods. This was one of the main needs identified by participants following the 2008 training. As monitoring is also a major activity in the UNU-INWEH project, there is extensive "in house" expertise and knowledge relevant to this region and its coastal areas. Monitoring allows for the observation of changes which may occur over time. This provides useful information on the status and trends of organisms and physical or chemical features of the environment. This in turn provides a better understanding of and allows for the prediction of future ecological patterns so they can be managed more effectively. Environmental monitoring is also a key factor in developing long term management plans and evaluating the effectiveness of management activities.

All PowerPoint presentations from this workshop can be found as PDF files at: <http://www.inweh.unu.edu/inweh/Coastal/Palm/Training2009.htm>

Objectives of the course

The aim of this 3 day training workshop was to demonstrate how to design and structure a coastal Environmental Monitoring Programme (EMP) and to discuss the different methods used for the broad range of coastal monitoring activities that exists today. Training covered different methods used for sampling physical, chemical, microbiological, and ecological parameters and involved descriptions of how to design a sampling scheme, the equipment and personnel required, temporal and spatial details of an EMP as well as data logging, storage and analysis. The training also aimed at sharing knowledge and experiences in environmental monitoring of coastal ecosystems amongst people involved in such activities throughout the region.

II. TRAINER AND PARTICIPANTS

About the Trainers

List of trainers and coordinators:

Dr. Peter Sale, Assistant Director, UNU-INWEH

Dr. Björn Kjerfve, Dean, College of Geosciences, Professor of Geography and Oceanography, Texas A&M University

Dr. Charles Trick, Professor, Department of Biology, Department of Microbiology & Immunology, Department of Pathology, University of Western Ontario

Dr. Ken Drouillard, Associate Professor, Biological Sciences, University of Windsor

Dr. Elise Marquis, Research Associate, UNU-INWEH

Dr. Georgenes Cavalcante, Research Associate, UNU-INWEH

Dr. David Feary, Research Associate, UNU-INWEH

Dr. John Burt, Lecturer, Zayed University, UNU-INWEH

Paolo Usseglio, Research Technician, UNU-INWEH

Andrew Bauman, Research Technician, UNU-INWEH

Dr. Edwin Grandcourt, Scientist, Marine Environment Agency, Abu Dhabi

Alex Grimm, Marine Ecologist/researcher

Nessrine Alzahlawi, Marine Ecologist/researcher

Hanneke Van Lavieren, Programme Officer, UNU-INWEH

Selection of Participants

For this training workshop, one or two representatives were invited from each of the States bordering the Arabian Gulf: Kingdom of Bahrain, State of Kuwait, Qatar, Islamic Republic of Iran, Republic of Iraq, The Sultanate of Oman, Kingdom of Saudi Arabia, United Arab



Emirates. From the UAE, 1-2 representatives were invited from each of the six emirates; Abu Dhabi, Dubai, Sharjah, Fujairah, Umm Al Quwain, and Ras Al Khaimah.

The participants included representatives from coastal management agencies, fisheries agencies, universities, government agencies, ministries, NGOs and research centres.

The final selection of participants was done in partnership with UNEP/ROWA and Nakheel. The list of participants is given as Annex 2 to this report.

III. TRAINING COURSE ACTIVITIES

Structure of the course

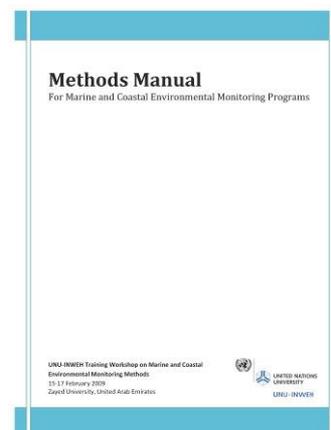
The structure of the course followed part of the outline of the UNU-INWEH Methods Manual for Marine and Coastal Environmental Monitoring programmes (available at <http://www.inweh.unu.edu/inweh/Coastal/Palm/Palmactivities.htm>).

A group exercise was performed as part of the training, and aimed at having participants apply their knowledge in a developing an EMP for a hypothetical coastal area (Annex 3).

A practical day in the field was organized on the third day of training. This gave participants an opportunity to have hands on exposure to the different methods and equipment used for the EMP and to try and practise their uses.

Course handouts

The course handouts were given out as a USB stick containing relevant files and the UNU- INWEH Marine Methods Manual for Marine and Coastal Environmental Monitoring Programmes.



IV. PROCEEDINGS OF THE COURSE

The final programme of the training workshop is given in Annex 1 to this report. The following section provides a short summary of the proceedings of the workshop.

DAY 2 16 February 2009

Opening and Introduction of participants

The workshop was opened by Ms. Hanneke Van Lavieren at 9.00am on Sunday, 15 February 2009. A short welcome was then given by Dr. Chet Jablonski, Assistant Provost, Research and Graduate Affairs, Zayed University. An opening speech from Dr. Habib El Habr, Director of UNEP Regional Office for West Asia (ROWA) was read by Ms. Van Lavieren on his behalf (Annex 4). This was followed by a short overview of the UNU-INWEH coastal management project in Dubai and the context of this training within this project, and a course orientation.



The opening was followed by Dr. Peter Sale who gave an introduction on how to plan and set up a coastal environmental monitoring programme. This session discussed the need to monitor coastal environments, defining goals, the nature of coastal ecosystems and system dynamics and implications for management, what data is needed and for what purpose, and the different kinds of environmental management i.e. no management, reactive management and proactive management. He also

gave an overview of needs for designing an EMP including parameters replication in space and time, data storage, reporting needs etc.

Next, Dr. Ken Drouillard gave a presentation on how to use monitoring in support of model-based management frameworks. He discussed how and why we develop enhanced monitoring programs to support science based decision support tools. Develop “what if” scenarios”, models are expensive, they conceptualize data, and can indicate variability in time and space, option for multi-stakeholder investment into a single model. Lastly, he described the two types of monitoring frameworks which exist, compliance and management monitoring, and how it is necessary to define which one is needed.

At 11.30am Dr. Charles Trick followed with a session on the value of water quality measurements for common goals. This session touched upon the different aspects of ecosystem health, human made-engineered structures, the role and different aspects to water quality measurements in monitoring the effects and managing engineered structures, sustainability in ecological and economic contexts, ecosystem resilience and examples, perturbation and altered ecosystem states, and the need for good, reliable data for effective monitoring.

After lunch, Paolo Usseglio presented methods for monitoring (reef) fish communities. He presented the different data that can be obtained (abundance, biomass, diversity and distribution), and how this information can be collected (methods) together with their limitations and practical needs, taxonomy, statistical procedures, as well as how it can be used to define management goals.

Andrew Bauman and Dr. John Burt next discussed Monitoring Coral Communities. This session touched upon the value of reefs, why they should be monitored, what methods are available for monitoring different variables, available software, what scale, frequency and level of detail should be considered, and the need to clearly define monitoring goals.



Dr. Björn Kjerfve followed with a presentation on the oceanography of the Arabian Gulf. He presented an overview of the different physical characteristics of the gulf, and how this information is important in defining a monitoring programme. He covered aspects such as population density, location of rivers and river discharge, residence times in the gulf, currents and water circulation, weather and wind patterns, salinity and temperature variations, tides, bathymetry and tectonics.

This was followed by a presentation by Dr. Georgenes Cavalcante on the types, applications, installation specifics of instruments, and software needed to monitor the oceanographic characteristics of a coast. Dr. Cavalcante then gave a detailed presentation of data processing and management and needed QA and QC procedures as well as data analysis options. This session covered the types and roles of physical data in monitoring, the definition and role of metadata, data storage options, quality control and accuracy options, data analysis, data inspection, data plotting and data interpretation.

DAY 2 16 February 2009

Paolo Usseglio started the day with a session on how to set up a field sampling programme. He covered such topics as logistical requirements, defining the need for field operations, staff needs, equipment considerations for achieving sampling goals, goal/question driven choices, that equipment choice should be based on need for data and accuracy and not only budget, and what parameters are measured by what instruments/equipment.

Dr. Elise Marquis then presented a session on plankton community monitoring. She gave an outline of what plankton is, plankton ecology, plankton distribution, the planktonic food web, why there is a need for plankton monitoring, which parameters to monitor and for what purpose, how to monitor for plankton, and also sample analysis.

Dr. Charles Trick followed with a presentation on monitoring water quality and plankton communities. He outlined the links between these two variables, what parameters need to be monitored, what species have what characteristics, how the dynamics of plankton communities indicate water quality, data interpretation, goals and measurements.

This was followed by a session on monitoring benthic communities by Dr. David Feary. He described how it is important to clearly define a question before beginning a monitoring program. He also gave a description of benthic communities, the need to monitor these systems, indicators of stress, what is required to monitor these systems, sediment characteristics, and then used the project as an example for monitoring these systems. He finished the discussion by going over methods and frequency of sampling, replication, site selection, sediment analysis, and some preliminary results.

Ms. Van Lavieren briefly introduced the group exercise for which the participants were split into 3 groups. Each group was asked to come up with parts of a monitoring and sampling plan for a hypothetical coastal area and situation. Groups were asked to present the outcomes at end of day 2.

Dr. Drouillard conducted a session on sediment chemistry and in place contaminant assessment and risk. This session focussed on setting sediment assessment objectives, sediment quality objectives in North America, sampling methods, equipment, laboratory processing, sampling needs and designs and geostatistical designs. He gave some examples of projects that look at sediment pollution by persistent pollutants in Canada and the US, including a detailed outline of the design of a monitoring programme for the Detroit River, and the hurdles faced.

Edwin Grandcourt presented fisheries Monitoring and assessment techniques in Abu Dhabi. He gave a short background on fisheries monitoring activities in this emirate and described what fisheries data is being collected, for what purpose and where. The session discussed both the trawls sampling methodology and the acoustic sampling methodology and discussed some results from both surveys. He also discussed different stock assessment methods, and some age based sock assessment results for some commercial species. Finally, he discussed some critical management issues and what regulations were implemented in Abu Dhabi to improve this.

Dr. Sale ended the day with a presentation on how to use monitoring data as input to a Coastal Management Plan and how monitoring data can be used to advise management. He discussed different management approaches including proactive versus reactive management, what is needed for both forms of management, the value of proactive management, and the need to better understand and investigate a system and its behaviour. He concluded that proactive management allows us to also look ahead (anticipate), instead of only trying to fix the past.

V. GROUP EXERCISE

The participants were split into 3 groups. Each group was asked to use the exercise and hypothetical coastal area as described in Annex 3. The groups were then asked to come up with the following:

Group 1: What are the management purposes? (*What are the potential issues (pollution etc.? What is your target condition? Conservation objective?)*)

Group 2: What physical and chemical parameters will you monitor? What are the methods to use? What biological (microbial) and ecological parameters will you measure and what are the methods that should be used?

Group 3: How can you ensure EMP measures change accurately? Where, what, and how often will you monitor?

The three groups presented their results at the end of the second day and a short discussion was held to discuss issues to deal with when designing an EMP, the need to communicate with and involve all stakeholders, costs for implementing an EMP and some constraints in designing EMPs in the region.

DAY 3 17 February 2009

A practical laboratory and field day was organized from 9 am 17 pm.



The participants were split in 2 groups. The first group visited the EHS marine laboratory while the other visited a site on Palm Jebel Ali for field exercise and demonstrations. The two groups then switched activities after lunch.

Within these two groups, participants were divided into smaller 3-4 person teams which rotated through the 4 focus areas (as listed below).

Four Focus (demonstration) areas:

- 1. Plankton and Water Quality:** Elise Marquis, Charlie Trick and Akila
- 2. Sediment:** David Feary, Ken Drouillard and Nesreen Zahlawi

3. Oceanography: Geórgenes Cavalcante, Björn Kjerfve, and Alex Grimm

4. Fish/Corals: John Burt, Paolo Usseglio and Andrew Bauman

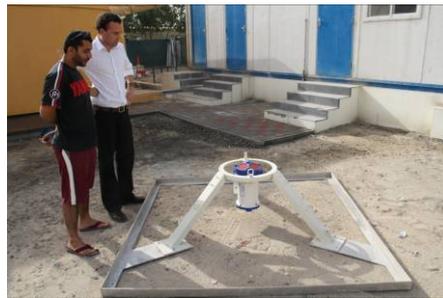
Lab group: venue: Trakhees-EHS Marine Laboratory.

This session covered different laboratory equipment requirements and methodologies. It also presented specific laboratory needs for monitoring coastal ecosystem and provided participants an opportunity to do some hands on testing of some equipment. Demonstrations of various software used was also given.



Field group: venue: Nakheel Palm Jebel Ali

This group was taken to Palm Jebel Ali where the UNU team demonstrated some of the field equipment and logistical needs for coastal monitoring. This session also involved demonstration of some field techniques and provided participants an opportunity to use and test some of the equipment.



ANNEXES

ANNEX 1

TRAINING PROGRAMME

DAY 1 15 February 2009

Venue: Zayed University

- 8.30 am Registration
- 9.00 am **UNEP representative and Hanneke Van Lavieren:** Welcome by UNEP and UNU-INWEH – rationale and outline of training workshop
- 9.15 am Introductions by all Participants
- 9.30 am **Peter Sale:** Introduction to setting up a coastal EMP (defining goals, approaches, scope etc)
- 10.00 am *Coffee break*
- 10.30 am **Ken Drouillard and Charles Trick:** Monitoring in support of model-based management frameworks. How and why do we develop enhanced monitoring programs to support Science-based decision support tools?
- 12.30 pm *Lunch*
- 13.30 pm **Paolo Usseglio:** Monitoring Fish Communities
- 14.30 pm **John Burt and Andrew Bauman:** Monitoring Coral Communities
- 15.15 pm *Coffee Break*
- 15.45 pm **Björn Kjerfve and Geórgenes Cavalcante:** Oceanography of the Arabian Gulf and Monitoring of Physical Variability
- 16.00 pm **Geórgenes Cavalcante and Björn Kjerfve:** Physical Oceanography Monitoring along the Coast of Dubai: Design, Parameters, and Instruments
- Geórgenes Cavalcante and Björn Kjerfve:** Data Processing and Management, QA/QC, and Preliminary Data Analysis; Hands-on session to program and down-load data from a ADCP unit
- 16.30 pm **Paolo Usseglio:** Setting up a field sampling programme: staff, field instruments and logistical requirements for sampling in the field

16.45 pm **Hanneke Van Lavieren:** Introduction and commencement of group exercise – will be split into 4 groups and each comes up with a monitoring and sampling plan for a hypothetical area and situation. Groups will be asked to present the outcome at end of day 2.

17.30 pm Close

DAY 2 16 February 2009

Venue: Zayed University

8.30 am **Charles Trick- Elise Marquis:** Monitoring Water Quality

Monitoring Plankton Communities

9.15 am **David Feary:** Monitoring Benthic Communities

9.45 am *Coffee break*

10.15am Group exercise: groups can work on their exercise for presentation and discussion in the afternoon.

12.00 am *Lunch*

13.30 pm **Ken Drouillard** Sediment chemistry and in place contaminant assessment and risk.

14.00 pm **Edwin Grandcourt-** Fisheries Monitoring Methods and input to coastal management plan.

14.15 pm **Peter and Hanneke:** groups present to a panel (of 5) their monitoring and sampling plans: 10 minutes each

15.00 pm General Discussion – Panel to respond

16.00 pm **Peter Sale:** How to use monitoring data as input to a Coastal Management Plan and how monitoring data is used to advise management (regular update/adjustment etc).

17 pm Close of workshop

19 pm Social Dinner (Grand Millennium Dubai)

DAY 3 17 February 2009

Venue: EHS laboratory and Field Site (Palm Jebel Ali)

Start 9 am

Group is split in 2 groups (approx 12 persons each). One laboratory and one field group. Within each 12 person team, we will divide participants up into smaller 3 person teams which will rotate through the various activities every 30-45 minutes. After lunch the two 12 person teams will switch, the ones who were at the lab will go to the field and vice versa.

Four demonstration groups

Plankton and Water Quality: Elise Marquis, Charlie Trick and Akila

Sediment: David Feary, Ken Drouillard and Nessrine Zahlawi

Oceanography: Geórgenes Cavalcante, Björn Kjerfve, and Alex Grimm

Fish/Corals: John Burt, Paolo Usseglio and Andrew Bauman

Lab group:

Venue: Trakhees-EHS Marine Laboratory.

This session will cover lab equipment requirements and methodologies will be discussed. Specific laboratory needs for monitoring coastal ecosystems will be presented.

Field group:

Venue: Nakheel Palm Jebel Ali

This group will be taken to Palm Jebel Ali where the UNU team will demonstrate some of the field equipment and logistical needs for coastal monitoring. This session will involve demonstration of some of the field techniques.

ANNEX 2

List of Participants

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ANNEX 3

The Group Exercise Exercise Training Workshop on Marine and Coastal Environmental Monitoring Methods

**Day 1
15 February 2009**

Site description:

A tropical coastal area. Prevailing currents are south east. Two major rivers flow out here. Two touristic islands off the coast. Habitats include coral reefs, seagrass beds and mangroves. Main coastal town in this area is Hypo with 100,000 inhabitants. A major port is located to the right of hypo in a large embayment and has many docks, inlets and piers. Upstream from river 1 extensive agriculture takes place along the rivers. There are resorts and golf courses on the east side of the coast.

What you need to do:

This area is becoming more and more popular for tourists to visit, mainly divers and eco tourists. You have been asked by the local government of Hypo to develop a long term environmental monitoring programme for this coastal area which will eventually feed into a management plan for this area. The EMP will: a) provide baseline data; 3) provide information towards developing the management plan; 3) provide opportunity to measure change.

Group 1

What are the management purposes? (*what are the potential issues (pollution etc), what is your target condition? Conservation objective?*)

Group 2

What physical and chemical parameters will you monitor what are the methods to use?
What biological (microbial) and ecological parameters will you measure and what are the methods to use?

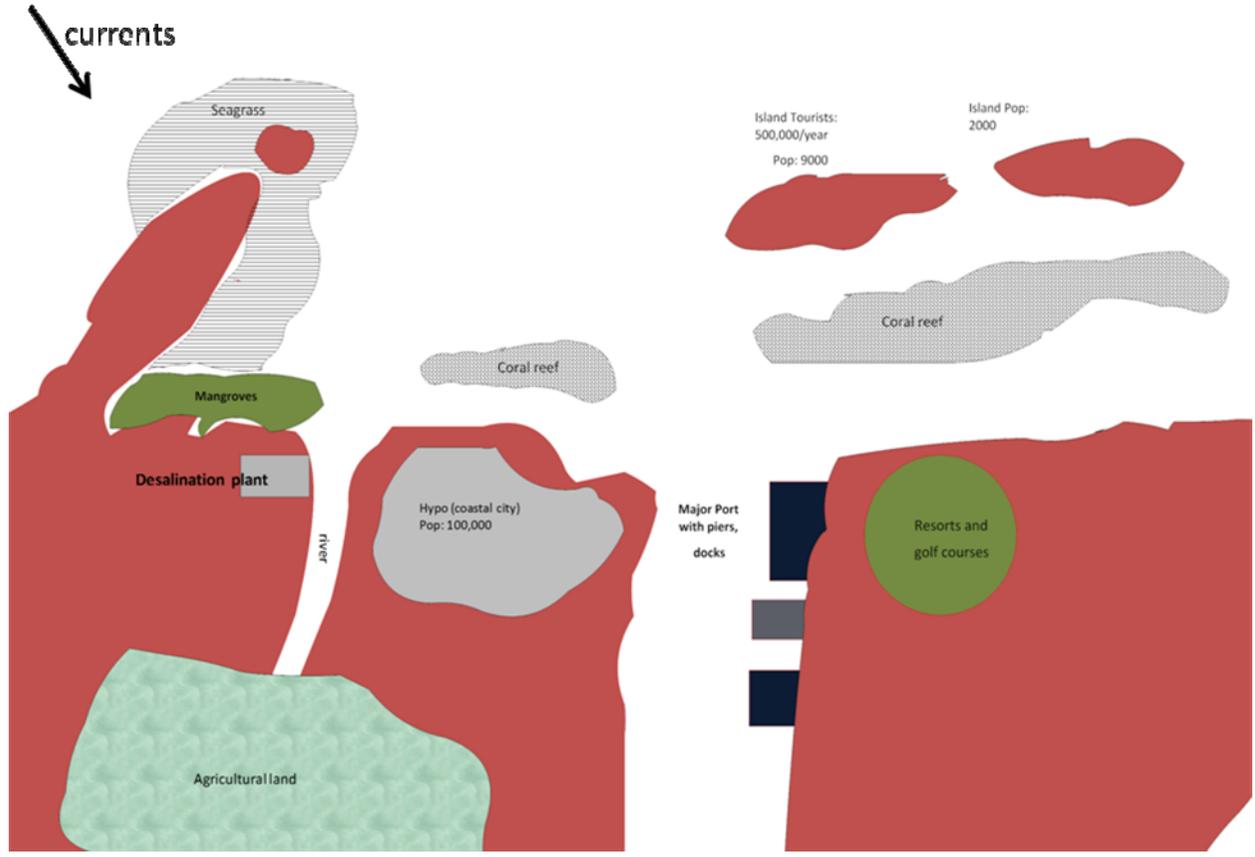
Group 3

How do I ensure my EMP measures change accurately? Where will you monitor for what and how often?

Each group will get approximately 1 hour to come up with a plan for each component. The 3 groups will then get 45 minutes to combine their plans into an overall EMP.

At the end of the exercise the groups will present their combined plan to a panel for discussion.

10 km



ANNEX 4



**WELCOMING STATEMENT TO THE
“TRAINING WORKSHOP ON MARINE ENVIRONMENTAL
MONITORING METHODS”**

OF THE

**UNITED NATIONS ENVIRONMENT PROGRAMME REGIONAL OFFICE FOR
WEST ASIA
(UNEP/ROWA)**

By

**Dr. Habib El-Habr
Director and Regional Representative**

**Dubai, UAE
15 February 2009**

Excellencies, Distinguished Colleagues, Ladies and Gentlemen,

The United Nations Environment Programme is pleased to have been able to join with the United Nations University in the organisation of this workshop on Marine Environmental Monitoring Methods. This activity is one of a number of activities in which we are working with UNU and we welcome this collaboration and this opportunity to provide capacity building to experts in the region towards the protection of our coastal and marine environments.

I would also like to take this opportunity to extend our gratitude to the Zayed University for hosting our workshop this week.

It is often said that we know more about outer space than we do about the depths of our oceans here on earth. We have over time used the seas and oceans as a dumping ground for our waste – especially in the middle of the last century when waste management followed a line of thinking whereby “the solution to pollution is dilution”. Thankfully, and with the hard work of our environmental scientists demonstrating the dangers of that approach, we have now moved on from there, but with continued development we are all the time using, and in many cases misusing, our coastal and marine environment.

This is where the concerted efforts of our colleagues at the Regional Seas Programmes, and also the relevant ministries and agencies at the national level, have and do play a very important role. But without good quality scientific data from monitoring and measuring, the right decisions about the protection of our marine and coastal environment cannot be made. I therefore urge you to take advantage of this course and of the experts before you, ask them questions, tap into their knowledge and take what you learn back with you to your places of work for the benefit of our seas, our region and the environment at large.

I would finally like to thank the speakers and all of those who contributed to the preparation of this event and the United Arab Emirates for their kind hospitality, and wish you every success as well as an enjoyable stay in this vibrant city.

Thank you

ANNEX 5

SUMMARY REPORT OF EVALUATION QUESTIONNAIRES

Training Workshop on Marine Environmental Monitoring Methods

15-17 February 2009
Zayed University, Dubai, UAE

An Evaluation Questionnaire was circulated to participants at the end of the course, with the results summarised below.

The Most Useful Parts of the Course:

Following review of the evaluation forms, it was found that the majority of participants found the presentations the most useful part of the course. A number of respondents indicated that presentations about project management, monitoring methodologies and sampling techniques e.g. for fish, coral, plankton, and benthic communities, were very informative.

Some participants commented that the presentations which highlighted case studies were very beneficial and that being able to question experts as well as the final discussion among groups was useful.

The Least Useful Parts of the Course:

Although the general consensus was very positive, several individuals expressed that materials presented should have focused solely on the Arabian Gulf region e.g. freshwater systems are not relevant to this region. Some respondents indicated that the presentations given covered a wide number of topics, and may not have been useful for all participants i.e. someone interested in corals might not be interested in sediment chemistry.

Other participants indicated that some parts were very specific and technical and perhaps too complicated for the audience.

Difficulties in Applying:

More than half the participants indicated that they would have no difficulty applying what was learnt during the course. However, several individuals expressed concern about the high cost of equipment used for monitoring and other respondents mentioned that studying physical oceanography and sediment analysis can pose challenges.

The Overall Feelings about the Course:

The overall feedback from participants was very positive. The general consensus was that the workshop was well organized and well executed. It was frequently mentioned that the majority of materials presented were interesting, useful, and practical e.g. learning about management plans.

It was also expressed that it was beneficial to meet experts from other nations and share views and experiences with other participants.

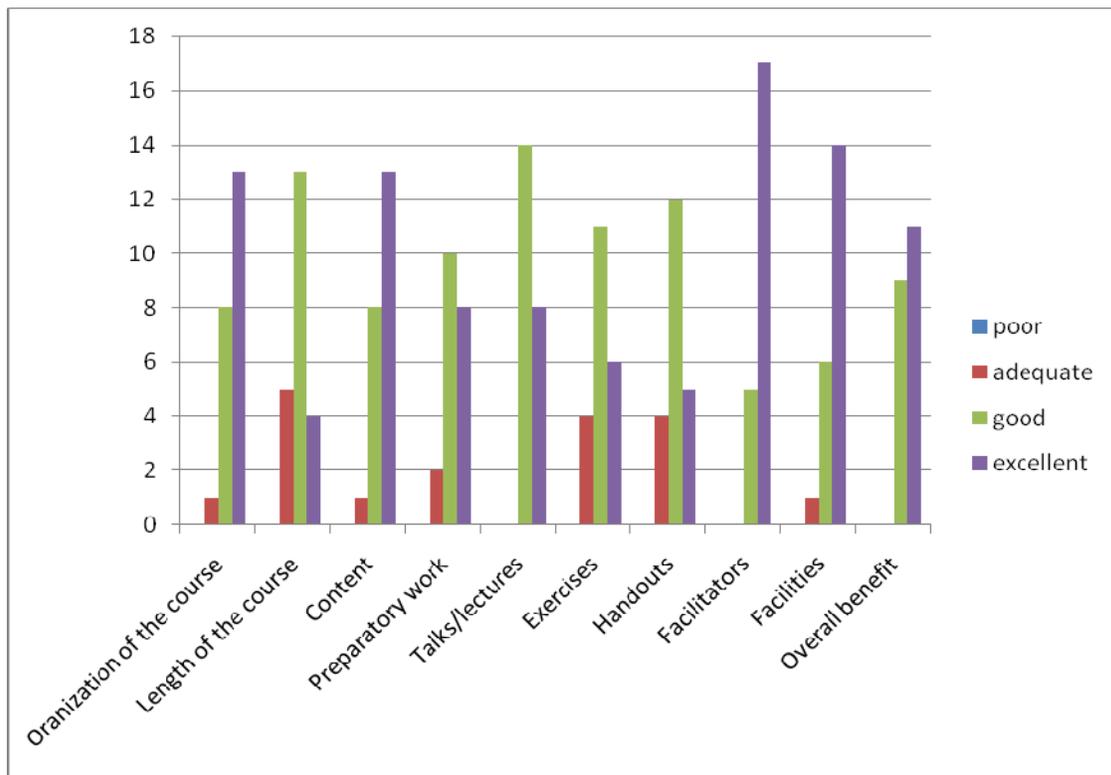
Most respondents were happy to have attended the course, look forward to applying what they learned, and showed sincere appreciation towards the conference organizers and hosts.

Other Comments:

In addition to the above comments, it was mentioned that some of the lectures were longer than necessary and some of the examples used were explained in too great detail.

It was also suggested that time should be available for the participants to present their expertise, their projects or environmental issues in their country, to share knowledge.

Summary Chart of Feedback in Section 2 of Evaluation Questionnaire



Suggestions for training workshops on related issues:

- Proposal writing – tips and tricks
- Cases studies – successes and failures
- EIA assessments for marine habitats – a potential tool for coastal management
- Socio-economic aspects of monitoring key habitats e.g. coral reef
- Sustainable use/harvesting of biological marine resources
- Coastal zone management planning - integration of environmental issues in the decision making and planning process
- Impacts of coastal development on coastal areas
- Artificial reefs in tropical areas
- Habitat restoration
- Mathematical modelling
- Data entry, processing and interpretation for monitoring issues
- Full workshop about environmental management
- Specific workshop about monitoring lakes
- Environmental laboratory workshop

EVALUATION QUESTIONNAIRE

This course evaluation will help us to develop a more effective course for future participants. In part 1, please provide your overall views on the course; in part 2, please comment on and rate the elements of the course on a scale of 1-4.

Thank you

Part 1:

The most useful parts of the course were:

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The least useful parts of the course were:

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I will have difficulty applying:

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My overall feelings about the course are:

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Any Other Comments

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Part 2:

	1 - Poor	2 - Adequate	3- Good	4 - Excellent
Organisation of the course				
Length of course				
Content				
Preparatory Work				
Talks/Lectures				
Exercises				
Handouts				
Facilitators				
Facilities				
Overall benefit from the course				

Part 3

Please list suggestions for training workshops on related issues:

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