CORAL TRIANGLE INITIATIVE
ON CORAL REEFS, FISHERIES AND FOOD SECURITY
PHILIPPINES

Science in Coastal Resources Management Foundation Course

Training Module

September 2013

This publication was prepared by the Marine Environment and Resources Foundation, Inc. (MERF, Inc.) in partnership with Conservation International (CI) for the Philippines' National CTI Coordination Committee with funding from the United States Agency for International Development's Coral Triangle Support Partnership (CTSP).

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ACRONYMS AND ABBREVIATIONS

CRMP	Coastal Resource Management Project
CRM	Coastal Resource Management
CTI	Coral Triangle Initiative
CTSP	Coral Triangle Support Partnership
EcoGov	Environmental Governance project
FISH	Fisheries Improved for Sustainable Harvests
FRMP	Fisheries Resource Management Program
HEI	Higher Education Institution
ICRMP	Integrated Coastal Resources Management Program
LGU	Local Government Unit
MAO	Municipal Agriculture Office
MERF	Marine Environment and Resources Foundation, Inc.
mKBA	Marine Key Biodiversity Areas
NGO	Non-government organization
NPOA	National Plan of Action
SUC	State Universities and Colleges
UMP	University Mentoring Program
USAID	United States Agency for International Development

PREFACE

Enormous strides have been achieved in natural resources management since the devolution of governance to local governments in 1991. However, the capacity for various aspects of fisheries management and conservation of marine resources remains constrained by the availability of expertise, funding, and a host of other economic and political considerations. Extension services and funds to enable national agencies to provide technical support to local government units (LGUs) are also insufficient.

Higher education institutions (HEIs) are in a position to provide much needed scientific support for decision-makers; however, not all of them are fully equipped for the task. Although there are national centers of excellence in marine science and related fields that continue to provide research outputs relevant to coastal resource management, there are too few of them to cover the technical needs of all coastal municipalities. Many of them are also located far from coastal areas where technical advice to inform decision-making is desperately needed.

The general focus of the Mentoring Program for Marine Sciences was to develop relevant and reliable partnerships between universities and local government units. The overall outcome is to have HEIs, starting with those in the Coral Triangle Support Partnership (CTSP) priority geographies (i.e., Batangas, Palawan, and Tawi-Tawi), and eventually in other parts of the country, networked with centers of excellence in marine and related sciences, which will improve capacity of these HEIs to provide technical assistance to LGUs in the implementation of the Coral Triangle Initiative National Plan of Action (CTI NPOA).

The specific objectives of the program were:

- To enhance the capacity of HEIs to conduct research to help address local coastal and marine resource management needs.
- To enhance the capacity of HEIs to provide technical support to LGUs in CTSP priority geographies.
- To provide mechanisms for exchange of information and linkage-building between HEIs and LGUs.

A major activity of the Mentoring Program was to conduct a Science in Coastal Resource Management Foundation Course as a base course for the mentees prior to undertaking specific case studies where they would apply the concepts and tools towards relevant issues in their respective areas. Through this training module, it is hoped that the course will be replicated to increase the expertise needed for more informed decision-making in coastal resource management.

INTRODUCTION

Local Government Units (LGUs) are the ultimate implementer of the Coral Triangle Initiative (CTI) National Plan of Action (NPOA). As with most policies on fisheries and coastal resource management as well as the overall rubric of environmental management, there is no recourse but to equip the LGUs and recognized frontliners to perform all these functions. Thus, recent development projects have heeded this call (CRMP, FISH, ECOGOV, FRMP, ICRMP, etc) by developing LGU officials and their functionaries in the complex world of coastal resource management. Several training programs (formal and non-formal) have been developed and implemented by these projects exclusively for the use of their beneficiary/partner LGU --- for Municipal Agriculture Officers (MAO), Planning Officers, Sangguniang Bayan/Lungsod members, etc. The academe and local NGOs have also been a healthy source of CRM practitioners. This has created a cadre of coastal management experts whom these projects have invested heavily upon. The crucial issue now is whether these trained CRM practitioners actually perform the functions they were trained for.

A complementary approach to improving the capacity of LGUs to implement the goals of the CTI NPOA is to select a trainee pool from an intermediate and scaled-up level: that of State Universities and Colleges (SUCs) or Higher Educational Institutions (HEIs). SUCs are physically proximate to the LGUs with the students and faculty residing within the immediate vicinities. Research and extension is at the core of their mission and they produce tons of data and scientific results from faculty researches and student thesis. Most faculty staff of universities are also well-respected and viewed as neutral entities which make them less exposed to politics and political influences. If the research, education, and extension work of SUCs in marine key biodiversity areas can be adjusted to target addressing key issues in coastal and marine resource management and conservation, they can provide a sustainable stream of knowledge for use by managers in making their CRM more effective.

Despite the seemingly lack of interest of students to enroll in fishery-related courses or the shift of focus of fisheries institutions to service-oriented courses such as nursing and information technology, HEIs in marine key biodiversity areas (mKBA) can still contribute substantially to guiding CRM efforts in nearby LGUs. Even if many of the HEIs in mKBAs do not offer formal degrees in biology, chemistry, marine sciences, or environmental sciences, research, education, and extension work for many of these HEIs can be adjusted to address common knowledge gaps in coastal and marine environmental issues.

RESEARCH THEMES AND TECHNICAL SERVICES REQUIRED BY THE CTI NPOA

The Philippines' CTI NPOA identified key research and technical services needed to support the implementation and accomplishment of NPOA goals, targets, and activities (Table 1). Technical services are often requested by LGUs to inform their decision options. This mentoring program initially aims to develop skills of scientists/faculty members of SUCs and HEIs in providing these technical services. For more advanced institutions, primary research can be undertaken. It should be noted that while this program initially aims to complement CTSP activities and targets, the broader objective of providing easily accessible and reliable scientific and technical support to local governments should not be overlooked.

Table 2 identifies skills / researches that are currently on-going or being planned for completion under the CTSP. These technical services and researches are the priority focus for this Mentoring Program since these have clear financial and logistic support from the USAID. This, however, does not preclude the expansion of the Mentoring Program to other opportunities for collaborative research and training in other projects or programs of the mentor or mentee universities.

Although the CTI presents five goals, these are actually interactive, overlapping, and hierarchical. Figure 1 shows how the five goals build-up to address current and urgent threats to coastal and marine resources and their sustainable use. Climate change, by itself, encompasses a wide range of fields and skills that are needed to assess the vulnerability of various coastal and marine resources, as well as to determine potential mitigation and adaptation measures. Climate change represents a threat that is superimposed on the localized threats such as overexploitation and sedimentation which are addressed through ecosystem-approach to fisheries management (EAFM) and spatial planning or zoning (e.g., Seascapes and Marine Protected Areas (MPAs)). Hence, climate change vulnerability assessments and adaptation measures will be the central theme for the Mentoring Program as the information and research needs to conduct these assessments requires technical services and researches in the field of EAFM, threatened species, seascapes, and MPAs.

Table1. Technical services and researches needed by local governments based on the Philippines' Coral Triangle Initiative's National Plan of Action and goals.Highlighted items refer to services and researches which could be directly used for the USAID CTSP under the activities of Conservation International – Philippines and the World Wildlife Fund – Philippines.

Research & Technical Services based on the CTI NPOA	NPOA GOAL
A. Technical assistance / services	
1. Biodiversity and habitat assessments *(fishes, invertebrates, marine plants, birds, cetaceans)*	Seascapes; MPAs; EAFM
2. Fish catch monitoring and analyses	EAFM
3. Fish stock assessments	MPAs; EAFM
4. Water quality monitoring	Climate change (adaptation)
5. Hydrodynamic / larval dispersal modeling for connectivity	Seascapes; MPAs
6. Resource mapping (GIS and remote sensing)	Seascapes; MPAs; Threatened species
7. Climate change vulnerability assessments (biophysical and coastal communities)	Climate change
8. Geo-hazard assessment and mapping	Climate change
9. Socio-economic assessments on human, social, financial, and physical assets of communities (users and uses)	EAFM
10. Resource economic valuation	EAFM
11. Value chain analyses on trading of priority marine taxa	Threatened species
12. Cost-benefit analyses for sea ranching, farming, full-cycle mariculture, and climate change actions / inactions	Climate change
13. Conflict resolution on tenurial instruments and trade-offs for coastal communities	MPAs; EAFM
14. Determining user fee values	MPAs; EAFM
15. Mainstream ICM and climate change in formal educational institutions	Climate change
B. Researches needed	
1. Threat assessment of exotic / invasive alien species (IAS)	Threatened species
2. Ecological interactions of artificial reefs with natural systems	overarching
3. Impact of coastal infrastructures on natural systems	overarching
4. Climate change impacts on biodiversity, fisheries productivity & sustainability, and ecology of coastal and marine habitats	Climate change
5. Species vulnerabilities / resilience to climate change impacts	Climate change
6. Ecosystem connectivity studies	MPAs
7. Oceanographic studies	MPAs
8. Reef fish and tuna spawning and spawning aggregations	EAFM
9. Fishing gear impacts on habitats and fishery resources (e.g., tuna)	EAFM
10. Adaptive fishing methods for an ecosystem approach to fisheries management	EAFM
11. Quantification / estimation of illegal, unreported, and undocumented (IUU) fishing	EAFM
12. Modeling climate change impacts on the marine environment	overarching
13. Impacts of Fish Aggregating Devices (FADs)	EAFM
14. Determine ecosystem carrying capacities	EAFM
15. Captive breeding and stock enhancement of identified threatened species	Threatened species
16. Identifying population and distribution of threatened species	Threatened species
17. Knowledge management (meta-databases and management information systems)	overarching

Table2. Technical services and researches needed by local governments under the USAID Coral Triangle Support Partnership Program and implemented by Conservation International – Philippines (CI) and the World Wildlife Fund – Philippines (WWF).

CTI Goals	CTSP Activities	Site	NGO	Technical support needed
Seascapes	- Management and Investment Plan for the SCS Seascape	- around the Western seaboard of the Philippines	CI	- Review of scientific information, policies, and governance in the Western seabord of the Philippines
MPAs	- Enhancing the NIPAS policy for seascapes	- NIPAS Seascapes	CI	- NIPAS and locally-managed MPAs site evaluation and data analyses
	- Development of CRM Plan for Lubang Island	- Lubang Island, Occ. Mindoro	CI	- Participatory CRM Planning - Coastal Area Zoning
	- Implementation of MPA management and CRM in Lubang Is.	- Lubang Island, Occ. Mindoro	CI	- monitoring of Lubang Island MPAs and coastal resources
Climate Change	- Implementing local climate change adaptation measures	- VA for Batangas - VA for Oriental Mindoro - VA & CCA Plan for Lubang Island	CI	- Coastal vulnerability assessments to Climate Change - identifying climate change adaptation measures to be incorporated into the Lubang-Looc CRM Plan
	- Training on Vulnerability Assessment	- Batangas - Oriental Mindoro		- Development of Climate Change Vulnerability Assessment module
	- Mangrove reforestation as CCA measure	- Calatagan - VIP-wide	CI	- identification of suitable mangrove reforestation areas - baseline mangrove assessments
EAFM and Threatened Species	- Policy on dulong fishery	- San Juan, Batangas - VIP-wide	CI	- Research on impacts of dulong fishery on sardine and anchovy fishery
	- live reef fish trade (Lapu-lapu)	- Tawi-tawi	WWF	
	- live reef fish trade (Mameng)	- Tawi-tawi	WWF	

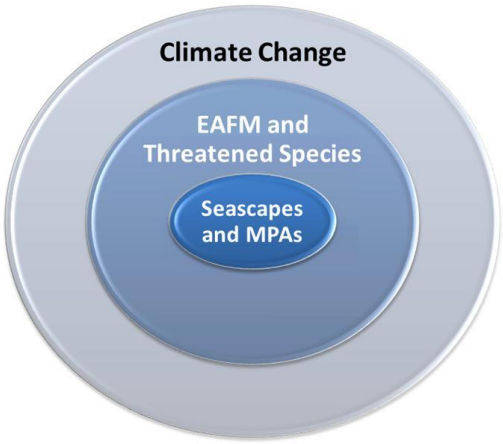

Figure 1. Coral Triangle Initiative goals illustrated according to overlap and hierarchy of complexity of research and technical service needs. The available technical support for most LGUs at present gets fewer as the ring gets larger. Climate change issues require greater knowledge and information to guide decision options and uses information gathered from EAFM, threatened species monitoring, seascapes, and MPAs. **EAFM = Ecosystem-Approach to Fisheries Management; MPAs = Marine Protected Areas*

UNIVERSITY MENTORING PROGRAM MODES

The University Mentoring Program (UMP) proposes several modes of mentoring as appropriate to the variety of level of expertise among the mentees. The difference between usual training courses and the University Mentoring Program is the continued commitment of marine science experts, dubbed as "mentors", in guiding their respective "mentees" (i.e., faculty of SUCs or HEIs in mKBAs) to apply basic marine science concepts in their own research, education, and extension activities within their university and local / provincial government. Mentees are given an opportunity to apply the knowledge they gained in an intensive training course through a research topic which they develop and apply for funding as part of the UMP. Advance course topics are then offered to mentees who wish to further enhance their knowledge and skills on selected aspects of marine science needed for CRM implementation.

UMP FRAMEWORK

Batches of faculty staff can be trained annually following three phases with the possibility of Phase III extending beyond one year, depending on the case study / research selected by the mentee and approved by the mentor (Figure 2). All selected applicants go through a foundation course that aims to level-off knowledge and skills of mentees in each batch and equips them with a holistic knowledge of common marine science concepts and skills used to support CRM. Phase 1 of the program involves a rigorous selection of applicants from a list of faculty submitted by administrators of participating universities. Phase 2 is the two-week intensive foundational course. Phase 3 is the implementation of a mentor-approved research topic that gives the mentees opportunities to apply the knowledge they

gained from the foundational course to real-world issues in their nearby coastal communities and ecosystems.

At the end of each fiscal year, the performance of mentees, both old and new, is evaluated based on their level of support to local government units and their skill levels / research outputs.

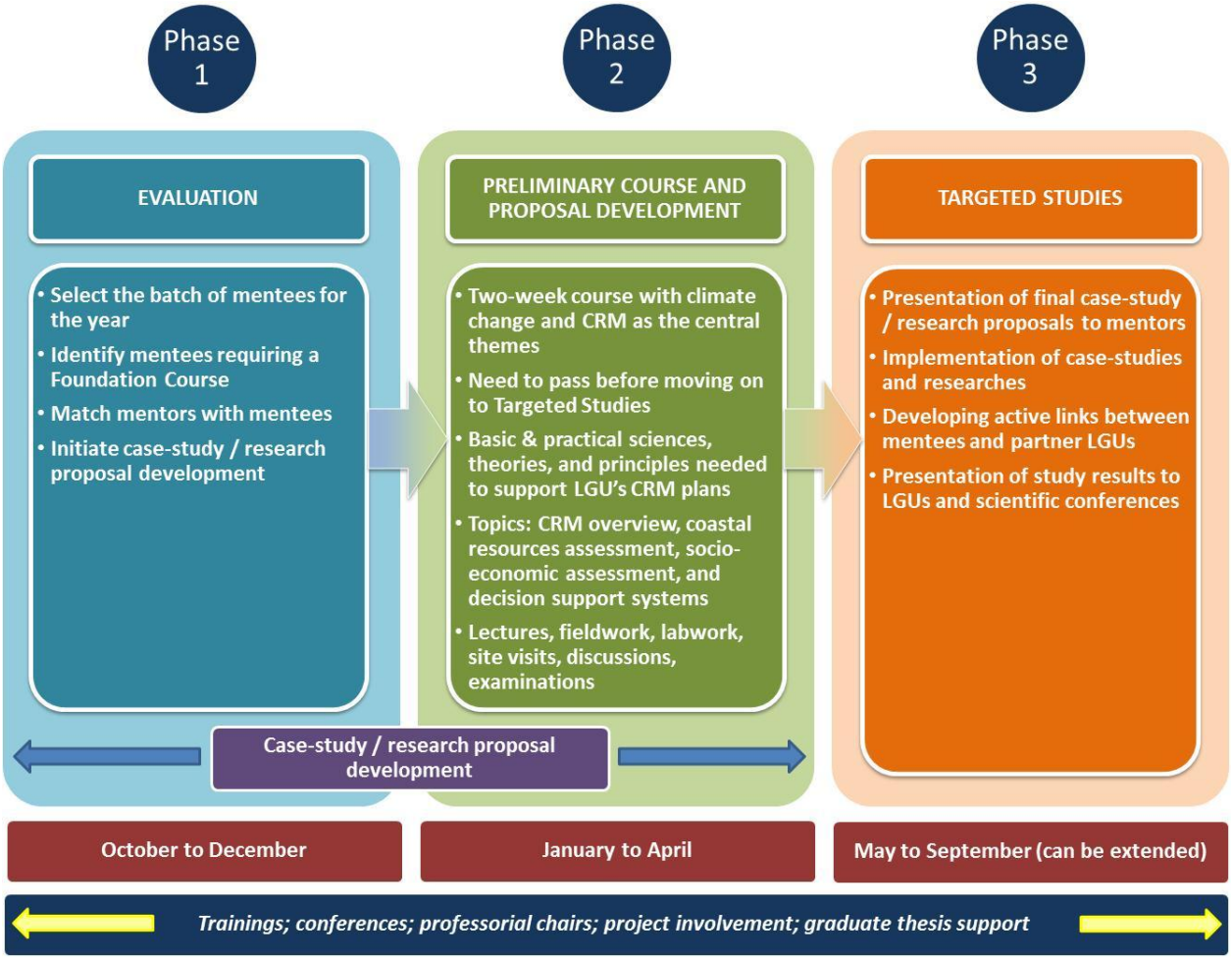

Figure 2. Proposed Mentoring Program phases per year from October 2011 to September 2013. The program is flexible enough to allow participation of mentees in other opportunities that may come along during the program implementation.

Phase 1. Evaluation

This evaluation phase involves determining which mentees would undergo particular mentoring modes. In particular, mentees will be distinguished as to those who would need to undergo the Foundation Course, and those mentees that can immediately write-up proposed case studies and research. This will also identify mentees to recommend for pursuing formal graduate programs. Curriculum vitae, interviews, and an evaluation form (see Annex A) will be used to select the mentees for each batch from the current pool of faculty and researchers provided by the mentee universities (see Annex B for list of current interested individuals and Annex C for the mentor individuals). Selected mentees will also be matched with mentors based on their field of expertise and/or interests. After which, mentees would

each have to start drawing up their case study / research proposal which will be presented and refined during Phase 2 of the program. The mentees are expected to begin development of their proposed case studies/ research projects that will be submitted for evaluation.

Phase 2. The Science in Coastal Resource Management Foundation Course

In the second phase, the Foundation course will be conducted for those identified mentees who need more background. This would be a course which will serve to give mentees an overview on the concepts and techniques for science-based coastal resource management. This would tackle topics on resource and socio-economic assessments and analyses, case studies for particular threats, and climate change assessments. Towards the end of the course, the other mentees would join in to learn from the case study presentations of the mentors.

This Training Module provides a guide for implementing the Science in CRM Foundation Course. During the course, mentees may be required to prepare a case study / research proposal for evaluation and approval of the mentors. Activities and research / technical service needs of the CTSP (see Table 2) can be used as basis for the case study / research topics. The proposal should focus on locally relevant issues and would be in support of LGU needs to implement the CTI Philippine NPOA. These should also be developed in collaboration with particular mentor(s) and presented / defended after the two-week course. It is expected that participants would have already started drafting a proposal right after they have been informed of their selection as a mentee for the current batch and a few months ahead of the foundation course schedule.

Phase 3. Targeted Research

A month after the Foundation Course, mentees will have to present their final case-study/research proposals to the mentors to get approval for funding. Approved case studies and researches will be implemented with guidance from the respective individual mentor(s). All case-studies / researches should be accomplished by August 2013 with final reporting and presentations concluded by September 2013.

Advance Training Courses

Mentees who successfully pass the Science in CRM Foundation Course may opt to apply for more advance training course topics. By ensuring that trainees obtain an understanding of foundational concepts on marine sciences that support CRM, advance courses can focus on teaching the mentees additional and complementary skills. This modular approach allows for quality control of mentees trained and provides an easier structured learning for mentees as advance training topics build on foundational topics covered in the Science in CRM Foundation Course. At present, an advance training course module has been developed on Climate Change Vulnerability Assessments for Coastal Ecosystems for Academicians and Teachers.

Other Modes

Formal graduate programs may be pursued in the programs of mentor universities. Mentees would need to fund their own matriculation fees, however research grants for theses/dissertations can be given based upon approved proposals through allocated funds from USAID CTSP. These researches must be in line with the on-going and planned activities of the CTSP and the targets of the program.

Trainings, workshops and symposiums will be conducted by the Program's organizers and partners. Mentees, depending on their field of interest, will be given the opportunity to participate. During the entire program implementation, the different topics covered in the Foundation Course will be developed and the knowledge and skills of mentees deepened and honed through other training programs.

Professorial chairs might be available. These will be targeted towards improving the collaboration links between HEIs/SUCs and LGUs.

These other modes of mentoring are open to all mentees regardless of the batch they are included in since many of these other modes are highly opportunistic and not programmed.

Program Annual Evaluation

Every end of the program, mentors may choose to evaluate the performance and development of their assigned mentee(s) with regards to their case studies/research and application of trainings received. Criteria for evaluation may include:

(a) Accomplishment of case-study / research objectives
(b) Ability to relate results to application and recommendations for LGUs
(c) Degree of interaction and collaboration of mentees with LGUs
(d) Clarity of presentation of results to LGUs

OVERVIEW OF THE SCIENCE IN COASTAL RESOURCE MANAGEMENT FOUNDATION COURSE

This course was designed to provide participants with the fundamentals of marine science and relevant disciplines and how to link these with coastal resource management (CRM) in the Philippines. The course covers topics related to science and research that are most useful and relevant to effective CRM, ranging from the physico-chemical characteristics of the marine and coastal environment to the biology and ecology of coastal habitats, flora, and fauna, as well as relevant socio-economic aspects. Aside from providing the participants with sufficient background to implement a case study or research project, the foremost objectives of the course are to provide practical knowledge and skills for providing technical support to local governments engaged in CRM, and to encourage the participants to incorporate marine environmental issues into their research, education and extension services.

The subject areas to be covered during the course include:

- Biodiversity and habitat assessments
- Water quality monitoring
- Hydrodynamics, larval dispersal, and pollution modeling
- Resource mapping (GIS and remote sensing)
- Climate change vulnerability assessments

At the end of the course, the students should be able to:

1) Discuss key marine ecosystem functions and processes based on physical, geological, chemical and biological concepts;
2) Examine current CRM issues within a scientific framework;
3) Propose methodologies to obtain scientific information to help address these issues; and
4) Recommend rational strategies to address these CRM issues.

PLANNING THE COURSE

Because the course is relatively specialized, it is recommended that prospective participants should be selected using the following qualifications:

- A faculty or research staff in an HEI
- With a BS degree in either Biology, Ecology, Chemistry, Environmental Science, or other related courses in the natural and marine sciences
- Committed to return to the home institution to conduct primary research and provide technical support services to nearby local governments
- Able to contribute new scientific information and publish results in internationally-refereed scientific journals
- Physically fit to do fieldwork

Lecturers should also have the necessary background and expertise relevant to the training modules to be facilitated. The outline and flow of the course is as follows:

Course Outline

- **I.** Introduction to the Philippine Marine Environment
    - a. Introduction to the Marine Environment
    - b. Integrated Coastal Management: Framework and Processes
- **II.** Physical Environment
    - a. Physical Oceanography
    - b. Coastal Processes and Sediments
    - c. Water Quality/Chemical Oceanography
- **III.** Coastal Habitats
    - a. Assessment of coral reefs
    - b. Assessment of marine plants
- **IV.** Fisheries Assessment
    - a. Fisheries Status and Management
    - b. Fisheries stock assessments/monitoring
- **V.** Integrative Discussion: Applying Scientific Data in Coastal Resource Management
- **VI.** Special Topics:
    - a. Coral Reef Restoration
    - b. Climate Change Vulnerability Assessments and Adaptation Planning
    - c. Mapping Coastal Habitat Resources and Features
    - d. Ecosystem Modeling

The first part of the course is an introduction to the marine sciences, both the scientific framework and tools and coastal resource management concepts. The second part consists of both conceptual and hands-on learning. The students are introduced first to the physical environment, including physical oceanographic concepts, coastal processes and sediments, water quality and other chemical processes. This provides the setting for the coastal habitats and fisheries which are tackled next. Coastal habitats covered include coral reefs and marine plants, particularly seagrasses and mangroves. Methods for monitoring and assessing these various coastal habitats, as well as fisheries resources, are tackled using a hands-on, on-site approach. The course can be structured such that students choose to focus on either the coastal habitats or the fisheries in order to provide more depth. This second part is concluded by a session on data analysis and interpretation, and a discussion on the integration of these assessments. The integration session will include the appropriate means of analyzing the data gathered and determining meaningful interpretations relevant to coastal resource management issues. The last part of the course covers special topics such as coral reef restoration, climate change, mapping coastal habitats, and ecosystem modeling. A sample schedule of the course is found in Appendix I.

Each module includes an introduction, objective, key teaching points, duration, logistical needs, suggested expertise of the lecturer, module flow, and a list of references.

MODULE 1. INTRODUCTION TO THE PHILIPPINE MARINE ENVIRONMENT

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Introduction

This module provides the context of the marine environment in the Philippines, highlighting the heterogeneity of the physical features in this archipelagic country that in turn affects the ecological systems. The diversity of the marine ecosystems in the Philippines is also introduced together with the myriad anthropogenic activities that are contributing to their degradation.

Objectives:

By the end of this module, participants will be able to:

1. Identify general physical characteristics influencing the marine environment of the Philippines
2. Describe the diversity of Philippine marine ecosystems and threats to these systems
3. Discuss the general challenges to understanding these ecosystems and application of scientific knowledge to coastal resources management

Key Teaching Points

1. The Philippines is situated in a highly complex and dynamic oceanographic system influenced by monsoons, large oceanic currents, and archipelagic configuration.
2. Appreciation of the key ecological functions of the Philippines' marine ecosystems and their context in global biodiversity
3. Understanding of the inherent variabilities these marine systems and their implications for science-based coastal resource management

Duration: 3 hours

Resource Requirements

- Room setup: LCD projector, projector screen, computer

Suggested Lecturer Expertise

- CRM practitioner or a marine science faculty with background in coastal resource management.

Module Flow

1 hour	**Lecture: The Philippine Marine Science Setting: A Diverse and Complex Setting** ***Instructions to the lecturer:*** Provide time for questions and discussions.	• Computer • LCD projector and screen
1 hour	**Lecture: Biodiversity and the Marine Environment**	• Computer • LCD projector and screen
1 hour	**Lecture: Science in CRM: Opportunities for Convergence with Local Government Units** ***Description:*** A brief review of CRM, its framework and process is given. The potential roles of scientists in the CRM process and how these can assist the local government units are identified and discussed. ***Objective:*** To orient the participants on the CRM context and cycle and discuss how HEIs can provide valuable technical assistance to the local government units engaged in CRM ***Instructions to the lecturer***: It is important to emphasize that HEIs can provide inputs at every stage of the CRM process.	• Computer • LCD projector and screen

MODULE 2. INTRODUCTION TO THE OCEANOGRAPHY OF THE PHILIPPINE ARCHIPELAGO

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Introduction

This module introduces the main features of the oceanography of Philippine waters to audience with little or no background in oceanography or marine science. The objective is to familiarize trainees and enable them to gain an appreciation of the applications of oceanography to science-based coastal resource management and to get some insights on ocean variability in the context of climate change.

Objectives

By the end of this module, participants will be able to:

1. Describe general oceanographic features and its variability in Philippine seas
2. Identify oceanographic processes relevant to coastal resource management
3. Use simple and inexpensive tools for measuring surface currents

Key Teaching Points

1. The Philippines is at the crossroads of major ocean currents in the NW Pacific and the SCS resulting in a very complex system which is further influenced by the complicated bathymetry and coastline geometry of the archipelago
2. Appreciation of variability of oceanic processes important in developing sampling strategies for CRM and vulnerability assessment exercises.

Duration: 1 day

Resource Requirements

- Room setup: LCD projector, projector screen, laptop computers for students
- Field requirements: Handheld GPS, data cable, boat, drogues

Suggested Lecturer Expertise

- Physical oceanographer with practical and field experience in coastal oceanography, particularly in measuring oceanographic parameters such as currents, bathymetry, etc.

Module Flow

Duration	Activity	Resource Requirements
2 hours	**Lecture: Oceanography of the Philippine Archipelago** ***Description:*** Current knowledge of the oceanography of the Philippines is discussed. The participants are first given an overview of the Philippine archipelagic setting and how the location and island configuration of the Philippine archipelago likely leads to a complex system. Oceanographic and atmospheric concepts that are necessary or relevant to understanding the general oceanography of the Philippine archipelago are then discussed. ***Objective:*** To provide participants with a background of the general oceanic and atmospheric processes that lead to the observed oceanography of the Philippine Archipelago ***Instructions to the lecturer:*** Examples/analogies are useful for improving the participants' grasp of the concepts discussed.	• Computer • LCD projector and screen
30 minutes	Break	
1 hour	**Field Group Exercise: Extracting Velocities from GPS Tracks** *(Field exercise on the beach; no boat necessary)* ***Description:*** Participants are introduced to the Lagrangian method of obtaining velocity information. The information/variables necessary to compute for velocities from the GPS track record is discussed. ***Objective:*** To introduce the participants to the simple method of obtaining velocity information based on the change in an object's position over time ***Instructions to the lecturer:*** 1. Participants may not have prior knowledge on the use of the GPS so an introduction/review of the different GPS functions may need to be discussed in detail. Ideally, each participant must be given time to familiarize himself with the GPS. Should there not be enough GPS units available, illustrations should accompany the lecture on the use of the GPS. 2. A review of trigonometric functions and the Pythagorean theorem may also be necessary prior to data processing/analysis.	• Handheld GPS for each group • GPS data cable • Computer • Whiteboard and marker
1 hour	**Lunch**	
1.5 hours	**Field Group Exercise: Using drogues for measuring surface currents**	• Boat • Life vests

	Description: Participants deploy drogues to measure surface current velocity. ***Objective:*** To allow the participants to try/practice the Lagrangian method of obtain current velocity information using drogues ***Instructions to the lecturer:*** Prior to going out to sea, an orientation on the drogue setup (i.e. parts of the drogue setup) should be done. Activities on the boat should also be outlined.	• Drogues: Holey-sack, rope, buoy • Handheld GPS • Container for GPS (e.g. airtight plastic container)
2 hours	**Data Processing and Analysis** ***Description:*** Participants are taught how to (1) download the data recorded by the GPS using the Garmin® (or equivalent) software, (2) compute for velocity, and (3) interpret the data. ***Objective:*** To teach the participants how to extract and process the data required to compute for velocity ***Instructions to the lecturer:*** Participants may need to be reacquainted with the different MS Excel functions that will be used to compute for velocities. All participants can work on the same dataset so that they can already perform the processing of the data as the lecturer walks them through the steps.	• Computer • Programs: MS Excel. Surfer/ Grapher may also be used for visualization of the velocities.
30 minutes	**Summary and Feedback** ***Description:*** The oceanography concepts and methods discussed are reviewed, and the participants are given time to ask questions, raise clarifications and give suggestions on how the lecture may be improved. ***Objective:*** To gauge what the participants have learned from the lectures and to obtain feedback from the participants.	

References

Gordon, A. L., and C. L. Villanoy (2011), *The oceanography of the Philippine Archipelago: Introduction to the special issue*, Oceanography, 24(1), 13, doi:10.5670/oceanog.2011.13.

Pond, S., and G. Pickard (1986), *Introduction to Dynamical Oceanography*, 2nd ed., Pergammon Press, Ltd., Oxford.

Stewart, R.H. (2008), *Introduction to Physical Oceanography,* Open-source textbook., Department of Oceanography, Texas A&M University, http://oceanworld.tamu.edu/resources/ocng_textbook/PDF_files/book_pdf_files.html.

MODULE 3: COASTAL EROSION AND SEDIMENT SOURCES AND TRANSPORT

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Introduction

The participants will be oriented on the hazard of coastal erosion and the various factors that can lead to land loss along the coast. They will also learn about the different sources of beach sediments and how sediments are transported along the coast.

Objectives

By the end of this module, the participants would have gained an:

1) Understanding of the hazard of coastal erosion and the various factors that cause coastal land loss
2) Awareness of the different possible sources of beach sediments
3) Understanding of littoral transport and how its modification or interruption can lead to coastal erosion.

Key teaching points

1) Coastal erosion is prevalent and can be due to various factors, both natural and human-induced.
2) Climate change is an exacerbating factor for coastal erosion.
3) There can be multiple sources of beach sediments. Coastal habitats, such as seagrasses and coral reefs, are important sources of carbonate sands.
4) Identifying the immediate cause/s of erosion is essential for formulating appropriate measures for addressing this problem.
5) The problem of coastal erosion transcends jurisdictional boundaries.

Duration: 2 hours lecture; half-day field exercise

Resource Requirements

- Room setup: Plenary set-up (tables and chairs may be arranged for activities later), computer, LCD projector and other materials to be specified by session lead

Suggested Lecturer Expertise

- Coastal geologist

Module Flow

Duration	Activity	Resource Requirements
30 minutes	**Lecture: Introduction** ***Context:*** Climate change is expected to exacerbate coastal erosion due to higher sea levels and stronger waves. However, it is equally important to know the other non-climatic and local factors that trigger coastal changes. Recognizing the immediate cause/s of erosion will aid in identifying appropriate measures for addressing this problem. It is important to establish trends in shoreline changes, both seasonal and long-term, in coastal vulnerability assessment. ***Objective:*** To make the participants aware of the hazard of coastal erosion and the different factors that lead to coastal land loss. ***Lecture Flow:*** 1. **Agenda** – Review agenda with the participants. 2. **How this can help you** – Get the participants attention and set expectations. This is the motivational slide for this module – heartfelt delivery! 3. **Participant input** – *What is the experience?* Encourage the participants to share their observations in their respective areas: (a) Whether the area is accreting or eroding; (b) Likely source/s of beach sediments; (c) What they think is the likely cause/s of such changes; (d) If climate change can already be perceived as a contributing factor; (e) How they address the problem of erosion in their communities.	• Computer • LCD projector and screen
30 minutes	**Lecture: Part 1 - Sediment sources and transport** ***Open Forum***	• Computer • LCD projector and screen
45 minutes	**Lecture: Part 2 - Case studies in the Philippines** ***Open Forum***	• Computer • LCD projector and screen
15 minutes	**Wrap Up:** *Ask participants to identify what they think are the take-away lessons.* 1. Review key teaching points 2. Remind people where to access reference materials 3. Re-emphasize the scope of the session 4. What are the next steps?	

References

Emery, K.O. 1961. A simple method of measuring beach profiles. *Limnology and Oceanography* 6: 90-93.

Fletcher, C.H., Mullane, RA., and Richmond, B.M. 1997. Beach loss along armored shorelines on Oahu, Hawaiian Islands. *J. of Coastal Research,* 13(1), 209-215. Fort Lauderdale (Florida), ISSN 0749-0208.

Komar, P.D. 1976. *Beach Processes and Sedimentation*. Prentice-Hall, NJ, USA, 429 pp.

Siringan, F.P., Berdin, R., Jaraula, C.M., Remotigue, C., Yacat-Sta. Maria, M.Y. and Zamora, P. 2005. A challenge for coastal management. *Know Risk*. United Nations, pp. 218-219.

MODULE 4. COASTAL WATER QUALITY MONITORING AND ASSESSMENT

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Introduction

Marine biological systems are inextricably linked to the abiotic environment manifested by the physical, chemical and geological features that characterize coastal habitats and marine ecosystems. This module provides participants with an appreciation of the chemical variables in the water column that impact on marine biological resources in coastal areas. It focuses on the characteristics of seawater and the parameters by which water quality may be assessed, along with the instruments and methods used to determine these parameters.

The module will include three training sessions. The first session will have classroom lectures while the second session will entail hands-on field exercises. The students will be involved in planning and preparations for the field activities. The third session will consist of hands-on laboratory exercises which will be conducted in a marine chemistry laboratory.

Objectives

By the end of this module, participants will be able to:

1. Learn about water quality parameters that are important to coastal habitats and ecosystems
2. Be familiar with monitoring water quality parameters, i.e. what parameters to monitor, why monitor, how to monitor
3. Understand and appreciate how water quality parameters are measured

Key Teaching Points

1. A clear understanding of the water quality parameters and their importance is needed to help determine which parameters will be used for monitoring and assessment of coastal environments.
2. Sampling design and monitoring plans are important determinants to the success of water quality assessment.
3. Credibility of water quality assessments is dependent on the competence of those involved in the activity, integrity of samples collected and standard procedures for water analysis, among others.

Duration: 1.5 days

Resource Requirements

- Room setup: Plenary setup, LCD projector, projector screen, computer

- Field requirements: boat, life vests, CTD or multi-parameter instrument, handheld GPS, Niskin sampler, rope, weights for sampler, Secchi disk, membrane filters, online syringe, sampling bottles, labels, slate, refractometer, BOD bottles, reagents and gear for DO analysis, pipets

- Laboratory requirements: oven, balance, sonicator, spectrophotometer, glasswares, reagents for DO, chlorophyll, and nutrient analysis

Suggested Lecturer Expertise

- Chemists with water quality monitoring experience

- Oceanographers

Module Flow

Duration	Activity	Resource Requirements
2 hours	**Lecture: Concepts, Principles and Overview on Coastal Water Quality Monitoring and Assessment** ***Description:*** This session introduces participants to water quality concepts (e.g. contamination, pollution, carrying capacity, etc.) and the relevance and practice of monitoring and assessment of water parameters for coastal resource management. ***Objective:*** To enable participants to appreciate the value of maintaining desired water quality vis-à-vis the coastal ecosystems	• LCD projector and screen • Computer • Sound system • Laser pointer
2 hours	**Lecture: Examples/Case Studies on Water Quality Issues for Coastal Areas** ***Description:*** This session answers the questions why water quality is monitored, what water quality parameters are important, and how these parameters are measured. These questions are discussed in the context of particular water quality issues in a coastal area. ***Objectives*:** To describe what is involved in conducting water quality monitoring and assessment	• LCD projector and screen • Computer • Sound system • Laser pointer
3-4 hours	**Field Exercise: Water Quality Monitoring** ***Description:*** Participants, together with the facilitators, will go on a boat to selected stations on the coast to determine station locations (using a GPS), physico-chemical parameters (depth, temperature, salinity, dissolved oxygen, Secchi depth, etc.), obtain water samples using a Niskin sampler, process and store the water samples for analysis in the training venue or back in the laboratory. ***Objective***: To demonstrate how water quality sample monitoring is conducted, including the use of field equipment	• Boat • Life vests • Field equipment: - CTD or multi-parameter instrument - Handheld GPS - Niskin sampler - Rope - Weights for sampler - Secchi disk - Membrane filters - Online syringe - Sampling bottles

		- Labels - Slate - Refracto-meter - BOD bottles - Reagents and gear for DO analysis - Pipets
2-4 hours	**Laboratory Exercise: Analysis of Samples** ***Description:*** Participants get hands-on experience with processing water samples that they collected and become familiar with tools and techniques used in the analysis of samples. ***Objective***: To provide general hands-on experience on the chemical analysis of basic water quality parameters	• Laboratory equipment: - Oven - Balance - Sonicator - Spectro-photometer - Glasswares - Reagents for DO, chlorophyll, and nutrient analysis
1 hour	**Post-field and Laboratory Discussion** ***Description:*** Participants, together with facilitators, will review the field and lab exercises, and discuss issues, problems and insights gained through these activities. ***Objectives:*** To assess field and laboratory exercises, and discuss results and how these are used for water quality assessment	• LCD projector and screen • Computer • Sound system • Laser pointer

References

Department of Environment and Resource Management (2009) Monitoring and Sampling Manual 2009, Version 2. ISBN 978-0-9806986-1-9.

San Diego-McGlone M, G Jacinto. 2009. Manual on Sustainable Coastal Aquaculture Monitoring: A Practical Guide. University of the Philippines. 90p.

EMB-DENR. 2008. Water Quality Monitoring Manual Vol 1: Manual on Ambient Water Quality Monitoring. 231p.

MODULE 5. CORAL REEF ASSESSMENT

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Introduction

The module will include three training sessions. In the first session, the participants will be provided with basic knowledge about coral reefs and will be oriented on reef monitoring methods and their role in the conservation and management of coral reefs. This is done with the objective of training the participants to help managers and other stakeholders to see the importance of reef monitoring and better specify their expectations from it, vis-a-vis the capabilities and limitations of current methods and technology.

In the second session, the participants will be provided an overview and some field exposure on current methods available, ranging from community methods (e.g., Uychiaoco *et al.* 2011, Reef Check) to non-specialist methods (e.g., Global Coral Reef Monitoring Network, English *et al.* 1997) and to more detailed and intensive image-based methods (e.g., GEF/WB Coral Reef Targeted Research Program, Automated Rapid Reef Assessment System or ARRAS).

In the last session of this module, the participants will be shown how data from Session 2 is encoded, processed and interpreted. This is to introduce the concept of statistical power and the importance of careful site selection to ensure that the monitoring can detect changes in reef status and that results are accurate.

Objectives

By the end of this module, participants should be able to:

1. Have a good understanding about coral reefs and its associated organisms
2. Describe the importance and role of a reef monitoring program
3. Enumerate and describe the key parameters in a reef monitoring program
4. Appreciate the similarities and differences of the various reef monitoring methods
5. Appreciate the key criteria used in choosing the most appropriate reef monitoring methods given the different management requirements and applications.
6. Understand the basics of processing reef monitoring data
7. Understand the concept of statistical power and how the methods may be adjusted to improve data precision and accuracy

Key Teaching Points

1. Coral reefs have tremendous ecological and socio-economic importance in the Philippines but are also facing significant threats from both natural and anthropogenic factors.

2. Most reef monitoring methods concern the quantification of reef state and less about the reasons and processes leading to an observed state.
3. The sessions of this module emphasize the quantification of coral cover and its determinants, but related methods for monitoring reef fishes, invertebrates and processes (e.g., coral growth, recruitment) will also be covered.
4. The goals of monitoring should be clearly spelled out, and the mix of monitoring methods should be adjusted to fit these goals.
5. Various monitoring methods differ in their characteristics and focus. For example, Reef Check methods emphasize quantifying human impact on reefs while GCRMN methods are for use of non-specialists but have specialized variants for meeting scientific/ecological objectives. Meanwhile, CRTR methods involve detailed, specialized techniques for monitoring both state and process variables.
6. There is no one "best" monitoring method.
7. The choice of sampling design and matching analytical methods are as important as the choice of the monitoring methodology to be used. All three have to be matched.

Duration: 1.5 days (Session 1: 1 hour; Session 2: 8 hours; Session 3: 2 hours)

Resource Requirements

- Room setup: chairs and tables that facilitates discussions among members of site groups, LCD projector, projector screen, computers, laser pointer

- Field requirements: boat, snorkeling gear, 100-meter line transect, slates, Reef Check training videos and land transect kit, field assistants

Suggested Lecturer Expertise

- Coral reef ecologist with experience in common coral reef monitoring methods (e.g., ReefCheck, benthic surveys, reef fish surveys);

- Certified SCUBA diver

Module Flow

Duration	Activity	Resource Requirements
Session 1: **1 hour**	**Lecture** ***Description:*** This is an introductory lecture to outline the adaptive management context wherein reef monitoring is ideally embedded in to further the conservation and management of coral reefs. A brief orientation on coral reefs and their importance is also discussed. ***Objective:*** To provide the participants with information that will allow them to help managers and other stakeholders to see the importance of reef monitoring and better specify their expectations from it vis-a-vis the capabilities and limitations of current methods and technology ***Instructions to the lecturer:*** Try to draw out from the participants hypothetical situations in which they see themselves playing in coastal management and biodiversity conservation. In doing this, try to emphasize to them that they have to be generalists, not specialists.	• Computer • LCD projector and screen • Laser pointer
Session 2: **8 hours** *(same day as Session 1)*	**Land and Field Exercises** ***Description:*** The participants will be taught an abbreviated version of the Reef Check Ecosnorkeller module and a survey will be conducted in a reef. Data from this exercise will be encoded, graphed and interpreted in the evening. ***Objectives:*** To provide the participants with actual experience in the conduct of reef monitoring (both simple and advanced methods) and show some of the actual challenges involved ***Instructions to the lecturer:*** Let the participants practice on land transects before doing the actual reef transect. Demonstrate also GCRMN line-intercept transects, CRTR photo-transects and perhaps the Teardrop module or photo-stitching of ARRAS.	• Boat • Snorkeling gear • 100-meter line transect • Slates • Reef Check training videos and land transect kit • Field assistants
Session 3: **2-3 hours** *(ideally the following morning to allow participants to rest)*	**Data Processing and Interpretation** ***Description:*** The participants will be asked to encode, graph (this is automated already) and interpret the Reef Check Ecosnorkeller data collected. Processing of data and images from the other methods will also be demonstrated. ***Objectives:*** Aside from their use in teaching the participants some basic concepts in data analysis, the data that they collected will also be used to demonstrate the statistical power (or lack thereof)	• Computer • LCD projector and screen • Laser pointer

	of their work and how this may be improved. ***Instructions to the lecturer:*** Reiterate that the role of scientists in conservation and management is to provide the objective, unbiased and accurate basis for decision-making. This means going beyond blind adherence to monitoring methodologies, and distinguishing the probable from the possible.	

References

English S, C Wilkinson, V Baker. 1997. Survey Manual for Tropical Marine Resources, 2nd edition, ASEAN, Australia Marine Science Project, Living Coastal Resources, Australian Institute of Marine Science, Townsville, Australia.

Hodgson G, J Hill, W Kiene, L Maun, J Mihaly, J Liebeler, C Shuman, And R Torres. 2006. Reef Check Instruction Manual: A Guide to Reef Check Coral Reef Monitoring. Reef Check Foundation, Pacific Palisades, California, USA. 86 pp.

Uychiaoco Aj, Sj Green, Mt Dela Cruz, Pa Gaite, Ho Arceo, Pm Aliño And At White. 2010. Coral reef monitoring for management. University of the Philippines Marine Science Institute, United Nations Development Programme Global Environment Facility-Small Grants Program, Guiuan Development Foundation, Inc., Voluntary Service Overseas, University of the Philippines Center for Integration and Development Studies, Coastal Resource Management Project, Philippine Environmental Governance Project 2, and Fisheries Resource Management Project. 122 p.

Van Woesik R, J Gilner, Aj Hooten. 2009. Standard operating procedures for repeated measures of process and state variables of coral reef environments. World Bank-Global Environment Facility Coral Reef Targeted Research and Capacity Building for Management Program. The University of Queensland, St Lucia, Qld 4072, Australia. 35 pp. – DOWNLOADABLE FROM www.gefcoral.org

MODULE 6. DESIGNING AN ASSESSMENT AND MONITORING PLAN FOR MARINE PLANTS

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Introduction

In this module, the participants will be familiarized with the characteristics, diversity, zonation, and importance of the marine plant ecosystems (seagrasses and mangroves), as well as the possible threats to these habitats.

Objectives

By the end of this module, participants will be able to:

1. Be familiarized with the typical characteristics and diversity of mangrove and seagrass habitats
2. Understand the zonation pattern within these habitats
3. Appreciate the ecological and economic importance of these habitats
4. Identify possible threats to these resources

Key Teaching Points

1. What are mangroves and seagrasses? How different are these plants from the land plants?
2. What are the typical characteristics of these species? Adaptation mechanisms?
3. Where can we find them?
4. What are the most common species?
5. Are they important?
6. What are the threats to these habitats?
7. What are the possible research areas for mangroves and seagrass?
8. How can we use the data that were collected for management?

Duration: 1.5 days

Resource Requirements

- Room setup**:** Plenary set-up, LCD projector, projector screen, computer, whiteboard, markers

- Field requirements: boat, slates, transect line, quadrat, corer, handheld GPS (2), tape measure (1 per participant), underwater camera (2)

Suggested Lecturer Expertise

- Biologist / Botanist with years of experience conducting assessments and researches related to marine plants (e.g., mangroves, seagrass, and seaweeds).

Module Flow

Duration	Activity	Resource Requirements
30 minutes	**Lecture: Introduction to the Module** Board exercise: What are the major differences of land and marine plants?	• Computer • LCD projector and screen • Whiteboard and markers
1 hour	**Lecture: The Seagrass Ecosystem** • What are seagrasses? • Why are they able to survive in marine waters? • What are the species of seagrasses? Global distribution? • How important are these grasses? • What are the threats to these seagrasses? • Can we determine the age of the grasses? What is the use of knowing the age of the seagrasses?	• Computer • LCD projector and screen
1 hour	**Lecture: The Mangrove Ecosystem** • What are mangroves? • How can these plants survive in a brackish-water environment? • What are the species of mangroves? Zonation pattern? • Geographical distribution and status in the Philippines • Ecological and socio-economic importance • What are the factors that threaten mangrove areas?	• Computer • LCD projector and screen
1 hour	**Lecture: Basic Techniques in Marine Plant Survey**	• Computer • LCD projector and screen
1 hour	**Lecture: Coastal Resource Management in the Philippines: Challenges and Opportunities**	• Computer • LCD projector and screen
4 hours *(next day)*	**Field Group Exercise: Assessment of Mangroves and Seagrass** ***Description:*** Participants will be exposed to adjacent mangroves and seagrass habitats and practice the different techniques in surveying marine plants	• Boat • Slates • Transect line • Quadrat • Corer • Handheld GPS • Tape measure • Underwater camera (2)

3 hours	**Data Analysis and Processing of Field Observations** How can the data collected for mangrove and seagrass research be used for coastal resource management? Inputs for writing scientific papers	• Computer • LCD projector and screen • Whiteboard and markers

References

Alongi, D. M. 2002. Present state and future of world's mangrove forests. *Environmental Conservation* 29(3): 331-349.

Coulter, S.C., C.M. Duarte, M.S. Tuan, N.H. Tri, H.T. Ha, L.H. Giang and P.N. Hong. 2001. Retrospective estimates of net leaf production in *Kandelia candel* mangrove forests. Marine Ecology Progress Series 221: 117-124.

Duarte, C.M., Marba, N., Agawin, N.S.R., Cebrian, J., Enriquez, S., Fortes, M.D., Gallegos, M.E., Merino, M., Olesen, B., Sand-Jensen, K., Uri, J. and Vermaat, J., 1994. Reconstruction of seagrass dynamics: age determinations and associated tools for the seagrass ecologist. Mar. Ecol. Prog. Ser., 107: 97-108.

Duarte, C.M., Thampanya, U., Terrados, J., Geertz-Hansen, O., and Fortes, M.D. 1999. The determination of the age and growth of SE Asian mangrove seedlings from intermodal counts. *Mangroves and Salt Marshes* 3, 251-257.

FAO. 2003. Status and trends in mangrove area extent worldwide. By Wilkie, M.L. and Fortuna, S. Forest Resources Assessment Working Paper No. 63. Forest Resources Division. FAO, Rome. (Unpublished)

FAO. 2007. The world's mangroves, 1980-2005. FAO For. Pap. 153, 77 p.

McLeod,E., Salm, R.V. 2006. Managing Mangroves for Resilience to Climate Change. IUCN, Gland, Switzerland. 64pp.

Polidoro, B.A., Carpenter, K.E., Collins, L., Duke, N.C., Ellison, A.M., et al. (2010) The Loss of Species: Mangrove Extinction Risk and Geographic Areas of Global Concern. PLoS ONE 5(4): e10095. doi:10.1371/journal.pone.0010095

Primavera, J. H. 2000. Development and conservation of Philippine mangroves: institutional issues. *Ecological Economics* 35 (Special Issue): 91-106.

Primavera, J.H., Esteban, J.M.A. 2008. A review of mangrove rehabilitation in the Philippines: successes, failures and future prospects. *Wetlands Ecology and Management* 16 (3): 173-253.

Primavera, JH; Rollon, RN; and Samson, MS. 2011. The pressing challenges of mangrove rehabilitation: pond reversion and coastal protection. In: Wolanski E and McLusky DS (eds.) Treatise on Estuarine and Coastal Science, Vol 10, pp. 217–244. Waltham: Academic Press.

Primavera, J.H., Sadaba, R.B., Lebata, M.J.H.L., Altamirano, J.P. 2004. Handbook of mangroves in the Philippines – Panay. SEAFDEC Aquaculture Department (Philippines) and UNESCO Man and the Biosphere ASPACO Project, 106 pp.

Samson, M.S., Rollon, R.N. 2008. Growth performance of planted mangroves in the Philippines: revisiting forest management strategies. *Ambio* 37(4): 234-240.

Samson, MS and Rollon, RN. 2011. Mangrove revegetation potential of brackish-water pond areas in the Philippines. In B. Sladonja (Ed), *Aquaculture and the Environment – Shared Destiny, pp 31 – 51.*

Spalding, M., Kainuma, M. and Collins, L. 2010. World Atlas of Mangroves. Earthscan Publication, U.K., 319pp.

White, A. T., Cruz – Trinidad, A. 1998. The Values of Philippine Coastal Resources: Why Protection and Management are Critical. Coastal Resource Management Project, Cebu City, Philippines, 96pp.

MODULE 7. FISHERIES ASSESSMENT

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Introduction

This module will include three training sessions. In Session 1 (*Importance of Fisheries Management),* the need for fisheries management in the country will be discussed with the participants. It will emphasize the finite nature of fisheries resources and explore ecosystem-based approaches to management. Session 2 (*Important Topics in Fisheries Research that lead to Management Initiatives)* will introduce a wide range of topics on information gaps in fisheries. How the gaps will contribute to management efforts will be explained to the participants. It is expected that they will take on at least one problem to investigate when they return to their respective units. In Session 3 (*Fisheries Catch Monitoring Program)*, the participants will be oriented on a monitoring program to characterize catch and effort data, as well as obtain biological status of stocks. This program has been tried and tested in a number of fisheries assessment studies, such as in the Fisheries Resource Management Project (FRMP) and FISH Projects of BFAR.

Objectives

By the end of this module, participants will be able to:

1. Discuss the need for fisheries management in the country
2. Explain and discuss the important components of Russell's Axiom and the different levels and effects of overfishing
3. Identify important fisheries information needed for management and discuss how each type of information is obtained
4. Construct a fisheries profile of an area
5. Characterize catch and effort through an understanding of the concepts of catch per unit effort (CPUE) and catch composition
6. Construct size/age structure of fish
7. Determine size at sexual maturity
8. Plan and undertake a monitoring program

Key Teaching Points

1. The finite nature of fisheries resources which depend on its ability to reproduce, recruit and grow against factors such as natural mortality and catch mortality
2. The presentation of scientific evidence on the effects and levels of overfishing
3. Discussion on the requirements of fisheries resource during each stage of fish development and assess how these requirements are measured and obtained
4. Concepts about dynamics of catch and effort
5. Concepts of fish growth, reproductive biology and ecology of fish resources

Duration: **2 days**

Resource Requirements

- Room setup**:** Plenary set-up (with tables and chairs), LCD projector, projector screen, computer, laser pointer

- Laboratory requirements: fish samples, measuring board, dissecting set, weighing scale, gloves

- Field requirements: notebooks, pens, voice recorders, camera

Suggested Lecturer Expertise

- Fish biologist or fisheries expert with experience in conducting fish stock assessments, fish catch monitoring, and evaluating fisheries management;

- Lecturer must have a good grasp of sampling design for fisheries and anatomy of fishes.

Module Flow

Duration	Activity	Resource Requirements
Session 1: 3 hours	**Lecture: Importance of fisheries management** ***Description:*** This lecture/discussion is an introduction to the importance of fisheries management in the country. It covers the nature of fish populations, how fish naturally replenish their populations and the factors that affect reproduction, recruitment, as well as the effects of fishing. Towards the end, various management strategies using ecosystem-based approaches are discussed. ***Objectives:*** 1. To discuss and explain the need for fisheries management in the country 2. To identify and discuss the important components of Russell's Axiom *3.* To discuss the different levels and effects of overfishing ***Instructions to the lecturer:*** The instructor is advised to cite different examples of fisheries (e.g. Atlantic cod fisheries, etc.).	• Computer • LCD projector and screen • Laser pointer
	Group Discussion, Case study, Scenario-building ***Description:*** During this session, the participants will identify key indicators of status of fish stocks in a given area (e.g., sizes of catch, catch per unit effort for various fishing gears). From the results, they will be asked to identify various factors that have contributed to the current status of fish stocks in their study area. They will then be asked to formulate action plans to arrest the decline of stocks and improve the condition of fish stocks based on the lectures. ***Objectives:*** 1. To identify important indicators of condition of fish stocks 2. To formulate appropriate action plans to arrest the decline of fish stocks and improve their condition ***Instructions to the lecturer:*** The instructor should ensure active participation of the participants. S/he must lead the discussion and elicit appropriate and doable action plans.	
Session 2: 2 hours *(same day as Session 1)*	**Lecture: Important topics in Fisheries Research that lead to Management Initiatives** ***Description:*** This lecture/discussion is about identifying important topics for research whose results could contribute directly to management initiatives. For example, the determination of size at	• Computer • LCD projector and screen • Laser pointer

	first sexual maturity is important in setting legal size limits of fish. ***Objectives:*** 1. Identify important fisheries information needed for management 2. Discuss how each type of information is obtained ***Instructions to the lecturer:*** The lecturer is advised to fully explain technical terms as needed.	
3 hours	**Laboratory Exercise: Measuring metric and meristic characters of fish, Otolith extraction and Gonad Analysis** ***Description:*** This exercise will provide participants with hands-on experience on how to measure metric and meristic characters of fish. In addition, this exercise will demonstrate to students how gonads and otoliths of fish are removed. Finally, the sex determination and staging of gonad maturity will also be shown. ***Objectives:*** 1. To demonstrate the proper way of processing fish samples for fisheries-related studies 2. To teach participants how to remove fish otoliths and gonads, and determine sex and stage of gonad maturity ***Instructions to the lecturer:*** It is important to allow each participant to undertake each task (measure metric and meristic characters, remove gonad and otolith and judge sex and maturity of fish) independently.	• Fish samples • Measuring board • Dissecting set • Weighing scale
Session 3: **4 hours** *(next day)*	**Field Exercise: Site Visit, Fisher Interviews on Fishing Dynamics** ***Description:*** Site visits and fisher interviews about dynamics of fishing are important to show the variation in catch composition between gears, catch rates and catch volume to the students. The manner on how they fish is also important to determine. In addition, the costs of fishing (e.g. gasoline, supplies) can also be helpful to better understand fishing dynamics. ***Objectives:*** 1. To show participants the various types of fishing gears used by fishers 2. To determine how each type of fishing gear is operated and the related costs ***Instructions to the lecturer:*** Discuss the importance/ relevance of this exercise. Plan the site visit by knowing the usual fishing hours in the area to ensure that participants will be able to catch the fishers before or after they go fishing.	• Notebooks • Pens • Voice recorders • Camera
4 hours	**Lecture: Develop a Catch Monitoring Program**	• Computer

	Description: This exercise focuses on developing a catch monitoring program to determine in detail catch composition and catch rates of important fisheries in a study area over a long term and following the correct statistical principles of sampling. These data are important because they will also establish the condition of fish stocks in the area and can lead to effective and efficient management initiatives. ***Objectives:*** 1. To provide participants an opportunity to develop a catch monitoring program following established and statistically sound designs *2.* To provide experience to participants on how catch composition and catch rates of various fishing gears are established ***Instructions to the lecturer:*** Time should be allotted for processing and discussing the impressions and observations of the participants from the site visit and interviews, as well as discussions on how to analyze the data obtained from the interviews. This lecture session integrates the learnings from the previous lectures and exercises.	• LCD projector and screen • Laser pointer

References

Armada, N.B. 2004. State of the demersal fisheries, p. 42-46. *In* DA-BFAR (Department of Agriculture – Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Bagenal, T.B. and F.W. Tesch. 1978. Age and growth. In. Methods for Assessment of Fish Production in Fresh Waters. T.B. Bagenal (ed.) Blackwell, London. pp. 101-136.

Beamish, R.J. and D.A. Fournier. 1981. A method for comparing the precision of a set of age determinations. Can. J. Fish. Aquat. Sci. 38: 982-983.

Beamish, R.J. and D.E. Chilton. 1977. Age determination of lingcod (*Ophiodon elongatus*) using dorsal fin rays and scales. J. Fish. Res. Board Canada 34: 1305-1313.

Beamish, R.J. and G.A. McFarlane. 1987. Current trends in age determination methodology. In. The Age and Growth of Fishes. R.C. Summerfelt and G.E. Hall (eds.) The Iowa State University Press, Ames, Iowa. pp. 15-42.

Beamish, R.J., G.A. McFarlane and D.E. Chilton. 1983. Use of oxytetracycline and other methods to validate a method of age determination for sablefish (*Anoplopoma fimbria*). Proceedings of the International Sablefish Symposium. Alaska Sea Grant Report 83-3. pp 95-116.

Hilomen V.V., W.Y. Licuanan, P.M. Aliño and L.F. Jimenez. 2002. Status of fisheries resources in Lingayen Gulf: Easing the pressure and enhancing the resources. Paper presented to the National Resource and Social Assessment Conference, Fisheries Resources Management Project, DA-BFAR, Development Academy of the Philippines, 6 March 2002

Hilomen, V.V., L.A.B. Meñez, V.S. Ticzon and K.F. Santos. 2001. Technical report on the rapid resource assessment of San Miguel Bay: status of coastal habitats. Post RSA Monitoring of San Miguel Bay Project, First Quarter Progress Report (August-November 2001). SEARCA, Los Baños, Laguna.

Jackson, J.B.C., M.X. Kirby, W.H. Berger, K.A. Bjorndal, L.W. Botsford, B.J. Bourque, R.H. Bradbury, R. Cooke, J. Erlandson, J.A. Estes, T.P. Hughes, S. Kidwell, C.B. lange, H.S. Lenihan, J.M. Pandolfi, C.H. Peterson, R.S. Steneck M.J. Tegner and R.R. Warner. 2001. Historical overfishing and the recent collapse of coastal ecosystems. Science 293:629-638.

Resource and Ecological Assessment of Ragay Gulf, Terminal Report. 1996 University of the Philippines Los Baños Foundation, Inc., College, Laguna.

Russ, G.R. 1991. Coral reef fisheries: effects and yields. In. The ecology of fishes on coral reefs. P.F. Sale (ed.), Academic Press Inc., San Diego, California pp. 601-635.

MODULE 8. INTEGRATIVE DISCUSSION: APPLYING SCIENTIFIC DATA TO COASTAL RESOURCE MANAGEMENT

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Introduction

This module introduces case studies on actual application of scientific research and data to inform and guide decisions in coastal resource management. Local case studies are drawn from experiences of the mentor and from literature to show the mentees how scientific research can feed into sustainable use of coastal and marine resources, reduce threats to people and habitats, and enhance the benefits we obtain from these resources.

Objectives

By the end of this module, participants will be able to:

1. Understand how the different topics covered in the course integrate and relate to each other to address real-world issues and problems in coastal resource management;
2. Critique and analyze the different application of scientific research on CRM case studies ranging from physical impacts to ecological and social issues;
3. Know how to apply the methods and skills learned from the course to address some of the common CRM issues

Key Teaching Points

1. Different scientific disciplines and approaches need to be integrated to address coastal resource management issues.
2. Long-term monitoring and assessments are necessary for understanding processes and solving CRM problems.

Duration: 3 hours

Resource Requirements

- Room setup needs: LCD projector, projector screen, computer, laser pointer

Suggested Lecturer Expertise

- Scientists / researchers who have been involved in multi- and inter-disciplinary researches that directly feed into policy and improved management of coastal resources. The lecturer may come from academic institutions, technical government agencies, consultancy offices, or non-government organizations providing technical guidance on coastal resource management.

APPENDIX I. Sample Course Schedule

Day 1:	Opening Program, Introduction of Participants, Expectation-setting Module 1 – Introduction to Marine Science
Day 2:	Module 2 – Physical Environment: Physical Oceanography
Day 3:	Module 3 – Physical Environment: Geological Oceanography
Day 4:	Module 4 – Physical Environment: Chemical Oceanography (Part 1)
Day 5:	Module 4 – Physical Environment: Chemical Oceanography (Part 2)
Day 6:	Module 5 – Coastal Habitats: Coral reefs (Part 1)
Day 7:	Module 5 – Coastal Habitats: Coral reefs (Part 2) Module 6 – Coastal Habitats: Marine plants (Part 1)
Day 8:	Module 6 – Coastal Habitats: Marine plants (Part 2)
Day 9:	Module 7 – Fisheries Assessment (Part 1)
Day 10:	Module 7 – Fisheries Assessment (Part 2)
Day 11:	Module 8 – Integrative Discussion Free time to prepare for presentations
Day 12:	Special Topics Presentation of action plans by each participant
Day 13:	Closing Ceremonies and Graduation

APPENDIX II. Sample Scenarios for Oral Exam

1. The scenario for fisheries management:
   What information would you need to design a fisheries monitoring scheme or program for a coastal municipality with several island barangays, and how would you get/collect this information (the scenario does not call for the actual design, but how to come up with one).

2. If you were asked to set up a demonstration site for reef restoration, which will you select and what will you do? What resources do you need in terms of manpower and supplies/equipment? Under what circumstances would you recommend reef restoration?

3. Site description:
   The site of interest is a coastal area in the town of Pacman with 100,000 inhabitants. The site faces the West Philippine Sea with two major rivers flowing out to the open sea; two popular tourist islands are located off the coast. Habitats include coral reefs, seagrass beds and mangroves. Upstream of the two rivers is extensive rice agriculture and milkfish aquaculture.
   What you need to do:
   This area is increasingly becoming a popular tourist destination, mainly divers and ecotourists. You have been asked by the local government of Pacman to develop a long-term environmental monitoring program for this coastal area which will eventually feed into a management plan for this area. The EMP will: a) provide baseline data; b) provide information towards developing the management plan; c) provide opportunity to measure change.
   A. What are the potential issues (pollution etc.) in this site? What is your target condition? Conservation objective?
   B. What physical and chemical parameters will you monitor? What are the methods you would use?
   C. What biological and ecological parameters will you measure and what are the methods to use?
   D. How do you ensure that your EMP measures change accurately?
   E. Where will you monitor, for what and how often?

4. Scenario for ICM and climate:
   How would you go about doing a coastal vulnerability assessment to prepare for disasters in the municipality that you are working on? Or specifically,
   For example in your municipality, how would you evaluate the potential impacts of climate change in relation to the sensitivity of the coral reef by gauging its exposure to increased incidence of thermal anomalies that leads to coral mortality from bleaching. What baseline information do you need?

5. An LGU has approached you asking about the possibility of putting up fish cages in a coastal area, whether this can be allowed and to what extent. You know nothing about the site. What initial questions will you ask? How would answers to those questions affect how you proceed?

6. Two adjacent towns in the west coast of Luzon are embroiled in a dispute over their municipal waters. Town A has jurisdiction over an island that is more front of town B than town A, thus leaving the fishers of the former a smaller, somewhat triangular fishing ground closer to mainland Luzon. Town A on the other hand gets a larger fishing ground broader around the island than the mainland. Describe how you are going to undertake a participatory assessment

and monitoring of fisheries, habitats, and other parameters that encourages greater collaboration and “give and take”/ compromise between Towns A and B.

7. Will establishing a protected area on a stressed reef result in an increase in the diversity of the area? Explain your answer with real or hypothetical examples.
   Should increasing and protecting biodiversity in a devastated reef be a main goal for establishing MPA’s? Why or why not?

8. Marine plants:
   A. How do you interpret an above zero and below zero net recruitment value?
   B. Why do mangroves show zonation pattern?
   C. What is the importance of determining the vertical rhizome elongation rate?
   D. How do you determine the number of plots that you need to survey in the mangrove forest?

APPENDIX III. Training Needs Survey

Enhancing the Role of Local Governments in the Implementation of the CTI National Plan of Action through Effective Partnership with State Universities and Colleges

Survey form for Research and Technical support capacities of SUCs to the CTI NPOA

We kindly request you to fill out the survey form. The outputs of this survey will be used in designing a mentoring program in support of key activities pertaining to research and technical assistance that will contribute to the achievement of the targets presented in the Philippines' National Plan of Action (NPOA) for the Coral Triangle Initiative (CTI). The mentoring program is aimed at identifying ways and supporting capacity building initiatives by which capacities of state universities and colleges (SUCs) and higher education institutes (HEI) can support the local governments in addressing key issues on coral reefs, livelihoods and food security in their respective areas.

The form is intended for faculty and researchers whose expertise and interest are in a select group of research themes and technical assistance, which have been identified in two workshops with local governments, SUCs and HEIs. The responses from the survey will help determine the capacities and interests of the SUCs and HEIs, in providing research and technical assistance to local government units.

Instructions:
Column 1 (Capacity) – describe your capacity to undertake the research or provide technical assistance

0 – have no capacity to conduct the research or provide technical assistance
1 - have some capacity to conduct research/ technical assistance BUT have not actually done it yet
2 – have the capacity to conduct research / technical assistance AND have implemented or currently implementing research

Column 2 (Skills) – list skills, tools, knowledge, and other resources that you already have to conduct the research or technical assistance.

Column 3 (Interest) – describe your interest in conducting the research. please rate from 0 to 4, with "0" (not interested) to "4" (very interested).

Column 4 (Skills or Tools Interested To Learn) - list specific skills, tools, or knowledge you would like to learn

Respondent's name: _____ Position: _____ Date: _____
University: _____ Field of specialization: _____

RESEARCH FOCUS	COLUMN 1 Capacity (0 - 2)	COLUMN 2 Skills / tools already known?	COLUMN 3 Interest (0 to 4)	COLUMN 4 Skills / tools interested in learning?
1. Threat assessment of exotic / invasive alien species				
2. Effects and benefits of artificial reefs with natural systems				
3. Impact of coastal infrastructures on natural systems				
4. Climate change impacts on:				
4a. Biodiversity				
4b. Fisheries productivity and sustainability				
4c. Ecology of coastal and marine habitats				
5. Species vulnerabilities / resilience to climate change impacts				
6. Ecosystem connectivity studies				
7. Oceanographic studies				
8. Reef fish and tuna spawning and spawning aggregations				
9. Fishing gear impacts on habitats and fishery resources (e.g., tuna)				
10. Adaptive fishing methods for an ecosystem approach to fisheries management				
11. Quantification / estimation of illegal, unreported, and undocumented (IUU) fishing				
12. Modeling climate change impacts on the marine environment				
13. Impacts of Fish Aggregating Devices (FADs)				
14. Determine ecosystem carrying capacities				
15. Captive breeding and stock enhancement of identified threatened species				
16. identifying population and distribution of threatened species				
17. Knowledge management (meta-databases and management information systems)				

Technical assistance usually required for CRM	COLUMN 1 Capacity (0 to 2)	COLUMN 2 Skills / tools already known?	COLUMN 3 Interest (0 to 4)	COLUMN 4 Skills / tools interested in learning
NATURAL / PHYSICAL SCIENCES				
1. Biodiversity and habitat assessments				
1a. Fishes				
1b. Invertebrates				
1c. Marine plants				
1d. Birds				
1e. Cetaceans				
2. Fish catch monitoring and analyses				
3. Fish stock assessments				
4. Water quality monitoring				
5. Hydrodynamic / larval dispersal modelling for connectivity				
6. Resource mapping (GIS and remote sensing)				
7. Climate change vulnerability assessments				
7a. Biophysical aspects				
7b. Vulnerability of coastal communities				
8. Geo-hazard assessment and mapping				
SOCIAL SCIENCES				
9. Socio-economic assessments on human, social, financial, and physical assets of communities (users and uses)				
10. Resource economic valuation				
11. Value chain analyses on trading of priority marine taxa				
12. Cost-benefit analyses for sea ranching, farming, full-cycle mariculture, and climate change actions / inactions				
13. Conflict resolution on tenurial instruments and trade-offs for coastal communities				
14. Determining user fee values				
15. Mainstream ICM and climate change in formal educational institutions				

2. Please choose from the above five research focus that you will be most interested to participate in and/or receive mentoring assistance.

1. _____
2. _____
3. _____
4. _____
5. _____

APPENDIX IV. Trainee Application Form

I. Applicant Details

Title: ☐ Dr. ☐ Mr. ☐ Ms. ☐ Other: _____

Surname: _____ Gender: ☐ Male ☐ Female

Given name: _____ Date of birth: _____

Middle name: _____ [Month / Day / Year]

Mobile telephone number: _____ Fax number: _____

Work telephone number(s): _____

Email address: _____

Correspondence address
(where mail should be sent):

_____

_____

II. Educational Background

Year		Name and place of institution	Field of study	Diploma / degree
From	To			
College / Vocational				
Graduate school				

III. Recent and related employment record

Year		Name and place of employer	Position	Responsibilities
From	To			

IV. Related trainings received

Year		Name and place of institution	Training course	Brief description
From	To			

V. Relevant skills

Please check all the relevant skills you have and provide a brief description of your level of experience and years of application

☐ Certified SCUBA Diver (indicated certification level): _____

☐ Snorkeller (years snorkeling): _____

☐ Chemist (license number): _____

☐ Use of statistical softwares (list softwares and experience): _____

☐ Use of chemistry equipment and techniques: _____

☐ Genetics and molecular biology (describe): _____

☐ Taxonomic identification (which taxons?): _____

☐ _____

☐ _____

☐ _____

☐ _____

Why do you want to attend this course?

_____

_____

_____

_____

_____

_____

_____

_____

VI. What do you plan to do after completing the course and the research work?

_____

_____

_____

_____

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_____

VII. Availability and accessibility to research equipment and laboratories

Please check the appropriate boxes and fill in the table below:

✓	Equipment	Description / details of equipment	Where can you access this equipment (e.g., personal, Biology lab, DENR, etc.)
	SCUBA diving gear		
	Snorkeling gear		
	Underwater camera		
	pH meter		
	DO meter		
	GPS		
	GIS software		
	Statistics software		
	Internet access (describe bandwidth & speed)		
	Boat		