INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
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МЕЖПРАВИТЕЛЬСТВЕННАЯ ОКЕАНОГРАФИЧЕСКАЯ КОМИССИЯ
اللجنة الدولية الحكومية لعلوم المحيطات
政府间海洋学委员会

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WESTPAC Training Workshop on Introductory Scientific Diving for Marine Benthic Dinoflagellates Sampling and Processing

17-21 September 2018, Phuket, Thailand

1. Background

In tropical coral reef ecosystems, marine benthic dinoflagellates are one of the significant biotic components. Marine benthic dinoflagellates are capable of producing various kinds of marine biotoxins and these can accumulate along food chains and pose a threat to seafood consumers.

Several genera have been known to be the producers of toxins related to ciguatera fish poisoning (CFP) and diarrhetic shellfish poisoning (DSP), affecting coastal populations that are relying heavily on reef fisheries. In addition to the amount of attention they have gained, owing to their harmful effects, marine benthic dinoflagellates have been identified as an alternative form of renewable energy and as a source of high-value bioactive compounds. Marine benthic dinoflagellates also harbour a high diversity of chemical substances with huge commercial potential.

Unlike planktonic microalgal blooms which often occur in the upper part of the water column, benthic dinoflagellates remain a mystery. It is therefore essential to sample and identify the benthic dinoflagellate species in the region, particularly of those that are responsible for CFP.

Scientific diving has been commonly used for underwater investigation and sample collection. It is defined as diving performed solely as a necessary part of a scientific research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving provides researchers with the capacity for direct observation and experimental manipulation, and is a research tool which requires underwater diving techniques for data collection and conducting scientific investigation.

Despite the increasing importance of scientific diving, it has been overlooked in the WESTPAC countries owing to the cultural misperception within the scientific community that it is merely a recreational tool that adds some value to shallow water science. There is no formal scientific diving training in the WESTPAC countries, and the majority of scientific divers can only obtain their certifications only through recreational diving training.

Lack of scientific diving training, a certification system and reciprocity remains a major obstacle for underwater scientists in the region to technology advancement, international academic exchange and research collaborations with other developed countries. Therefore, scientific divers

must be trained to use this tool to a level of proficiency that allows them to focus on the research task and keep themselves safe.

2. What this training aims to achieve

This training workshop is an intensive high-level training held in this region on carefully defined scientific subjects. It will be presented by several tutors of international standing. This training workshop aims to train young scientists and the government authorities in the region in the standard protocols for introductory scientific diving, underwater sampling, sample processing, culturing and identification of marine benthic dinoflagellates.

3. How the training will be conducted

This intensive five-day training workshop will consist of two parallel programmes, with **Programme I** as an introduction to scientific diving, and **Programme II** on sample processing, identification and culturing techniques for marine benthic dinoflagellates.

This workshop will be conducted through lectures, presentations, hands-on training, scientific diving training, field work training workshops, and roundtable discussions at the end of each day to wrap up and summarize findings.

Lectures will cover techniques involved in underwater sampling, processing and identification of species; both conventional and advanced techniques. The use of various preservatives in sample treatment and species identification will be discussed. The laboratory/hands-on session will cover application of the single-cell isolation by micropipetting technique, culture media selection and axenic/ non-axenic culture preparations.

4. Who can participate

Most participants, particularly those who are conducting marine benthic dinoflagellates related research, will be identified through the relevant scientific network(s), and/or the nominations of the IOC National Focal Points for WESTPAC. Other participants who are interested to join the event will also be welcome.

Although scientific diving is an exciting, challenging and adventurous activity, it can be dangerous and even fatal because it involves conditions and an environment beyond recreational diving. For those who are interested in the introductory scientific diving and underwater sampling, please refer to the requirements as described in the Annex.

5. How to register or apply for financial assistance

For anyone who is interested in joining this training, please fill in the attached Application Form.

There is a very limited resource in support of the international travel of some selected applicants, particularly those from the developing states. A joint committee will be established to select the most suitable participants who will be provided with financial support. The selection will be made mainly based on the applicant's CV, his/her descriptions about work experience in the Form, and his/her engagement in WESTPAC or other international programmes. Updated information on the workshop will be made available, in due course, on the WESTPAC website (http://iocwestpac.org).

Please submit, at your earliest convenience, the application forms duly completed to Ms Nachapa Saransuth (n.saransuth@unesco.org) and Ms Kingkanjana Sangtunchai (kingkanjana.pouy@gmail.com), with a copy to: skhokiattiwong@gmail.com and w.zhu@unesco.org, preferably not later than **8 August 2018**.

Annex: Details of the two parallel programmes

Programme I: An introduction to Scientific Diving

This introductory course is designed to familiarize certified recreational divers with basic scientific diving techniques and methodologies for collecting biologically relevant data from either fresh or marine environments. Topics covered include site mapping, estimating plant or animal population parameters, and data acquisition while underwater. Specific research techniques will be taught during the training.

The academic portion of this introductory course involves presentations and discussion in the following areas:

- Scientific Diving Introduction
- Scientific Diving Applications
- Scientific Diving Training and Skill Sets
- Scientific Diving Risk Management and Problems which may be faced
- Scientific Diving - Marine Benthic Dinoflagellates
- Scientific Diving - Extreme Environments
- Scientific Diving in the deployment of Coral In situ Metabolism (CISME) which is a diver deployed in situ respirometer for non-destructive measurements of reef coral respiration, photosynthesis and calcification.

Scientific Diving skills sessions will be conducted in both confined pool and open water environments. Students will also learn how to use various scientific equipment and skills such as quadrats, transects, visual censusing of aquatic organisms, 'Coral Watch', 'Coral Finder", CISME, BETA sampler etc.

Course Requirements

Contact Hours:

30 hours in total (15 hours lectures/presentation/discussion and 15 hours in water training).

Prerequisites: Each student must show proof of the following prior to beginning the course:

- Open Water Scuba Diver certification from a nationally recognized diver training organization
- Medical statement (If there is any "Yes" to questions on the medical statement, please consult your doctor for safety purposes before joining our courses.)
- Liability release
- Statement of standard safety
- Insurance specific to scuba diving
- Swim-test/Permission of instructor - potential students must demonstrate swimming/watermanship ability acceptable to the instructor, including but not limited to:
  - ✓ Swim underwater 25 meters/yards without surfacing.
  - ✓ Swim 400 meters in less than 10 minutes.
  - ✓ Tread water for 15 minutes (last 2 minutes without the use of hands).
  - ✓ Snorkel with fins 800 meters in less than 17 minutes.
  - ✓ Transport another person of equal size 25 meters in the water.
  - ✓ Tow another diver 100 meters in less than 4 minutes.
- Attendees must attend all class sessions and field excursions/dives.

Equipment:

Student divers are encouraged to provide all of their own diving equipment, with the exception of scuba cylinders/tanks.

Required Personal Equipment:

All participating divers must provide their own:

- Mask, Fins, Snorkel
- Exposure Suit (3mm wetsuit at minimum)
- Hood, Gloves, and Boots
- Knife
- Underwater computer
- UW Torch
- UW Compass
- Equipment bag

Additional Required Equipment:

All participating divers must also be equipped with the items listed below. If not personally owned, these items can be possibly provided by the PMBC. Please contact Ms Lalita Putchim (lalitaputchim@gmail.com) in advance for more details.

- Regulator with alternate air source, low pressure inflator hose, and submersible pressure gauge
- Depth gauge and timing device/watch
- Buoyancy compensator (BCD) with power inflator
- Weight system with weights (weight belt or BC-integrated weights acceptable)
- Whistle (for surface signalling)

Course Objectives:

Upon completion of the course, students will be able to demonstrate acquired knowledge by successfully answering questions on an objective examination of the following topics:

1. Plan and execute safe and productive scientific research dives
2. Collect data using visual, photographic and/or video equipment
3. Collect data using scientific equipment
4. Survey a population of organisms (plant and animal)
5. Analyze and present the population and habitat data collected
6. Identify the problems and hazards of research diving, and demonstrate the techniques and procedures needed to minimize their occurrence or impact

Course Deliverables:

Successful completion of the course by the candidates allowes for placement into CMAS Scientific Diver Level 1 Certification issued by the World Underwater Federation (CMAS) and Introductory to Scientific Diver Certification issued by Sea Dweller Underwater Academy (SDUA).

Programme II: Sample Processing, Identification and Culturing Techniques for Marine Benthic Dinoflagellates

Marine benthic dinoflagellates are capable of producing various kinds of marine biotoxins. These marine biotoxins can accumulate along food chains and pose a threat to seafood consumers. For example, *Gambierdiscus* spp. produce potent gambiertoxins (GTXs) and ciguatoxins (CTXs) which induce ciguatera fish poisoning (CFP) in humans. Reports indicated that there are associations between climate change, ocean acidification and the expansion of the distribution of toxigenic benthic dinoflagellates.

In tropical coral reef ecosystems, human exploitation and anthropogenic disruption often initiate shifts in the ecosystems and are expected to have significant impacts on the structure and resilience of communities. Among the micro-inhabitants in the reef ecosystems, the marine benthic dinoflagellate is one of the significant biotic components; several species have been found to be harmful and responsible for human illnesses. Ciguatera Fish Poisoning (CFP), a phycotoxin-borne illness, caused by several species in the genus *Gambierdiscus*, is affecting coastal populations that are relying heavily on reef fisheries. Outbreaks of certain species (i.e. *Ostreopsis*) produce air-borne biotoxins that are associated with illnesses to the beach visitors, unswervingly affecting beach tourisms. Although marine benthic dinoflagellates dynamics, their abundances and compositions have been intensively studied, detailes are scarce on the spatial and temporal scales. In addition to the amount of attention they have gained, owing to their harmful effects, mairne benthic dinoflagellates have been identified as an alternative form of renewable energy and as a source of high-value bioactive compounds. Marine benthic dinoflagellates also harbor a high diversity of chemical substances with huge commercial potential.

Unlike planktonic microalgal blooms which often occurred in the upper part of the water column, no visible environmental phenomena such as blooms/ red tides can be easily linked to benthic dinoflagellates, and outbreaks are often overlooked. Scuba diving has been commonly used for underwater investigation and sample collection. In this workshop, a combination of scientific diving and the application of a benthic and epiphytic dinoflagellate sampler as well as the artifial substrate sampling method will be used to collect marine benthic dinoflagellates in the coastal coral ecosystems in Thailand.

This programme aims to train young scientists and the government authorities in Asian countries in sampling, identification and culturing of marine benthic dinoflagellates. Lectures will cover techniques involved in sampling, sample processing and identification of species. The use of various preservatives in sample treatment and species identification will be discussed. The laboratory/hands-on session will cover application of the micropipette isolation technique, culture media selection and axenic/ non-axenic culture preparations. Up-scaling of cultures is crucial for the production of bioactive compounds for commercial purposes.