



23-31 MARCH 2023, MARHE CENTER, MALDIVES

CORAL REEF FISHES: IDENTIFICATION, ECOLOGY, AND CHALLENGES IN A WARMING OCEAN WORKSHOP

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INTRODUCTION

Coral reefs are one of the most biodiverse environments on the planet, one of the most incredibly varied habitats in terms of shapes, colors and organisms, as well as one of the most beautiful and majestic places we are lucky enough to observe. In this tropical environment, fish communities are a key and vital component for maintaining ecosystem balance and health. Fish usually represent the first element we notice when observing the submerged environment; they colonize any habitat accessible or inaccessible to the diver, modifying it, and are in turn affected by it. Although coral reefs represent less than 1% of the surface of the oceans, they are home to about 25% of known fish species. The fish fauna associated with coral reefs thus represents a fascinating system in terms of richness, complexity and biodiversity, especially in the coral reefs of the Indo-Pacific, where more than 4000 species live overall. The coral reef fish fauna constitutes an accessible study subject, since it is mainly composed by relatively sedentary species, therefore easy to find, and short-lived compared to a human scale. In particular, in the coral reefs of the Maldives, which represent about 5% of the area occupied by all the world's coral ecosystems and represents the 7th largest coral reef system in the world, more than 1100 species of fish have been recognized, with a variety of shapes, colors and behaviors that reflect the extreme complexity of the reef ecosystem. These multitude of traits are used by fish to feed, prey, defend themselves or "communicate" and interact with each other and with other organisms, by creating symbiotic association.



In addition, the coral reef fish community is also characterized by complex ecological interactions and trophic relationships that generate intricate food webs and ecological networks, whose balances are essential to maintain to support the high ecological functionality of the reef ecosystem. However, also the fish fauna is strongly affected both directly and indirectly by the climate change and the warming of the oceans which are modifying the structure and functionality of the habitat in which they live. The fish fauna thus constitutes an excellent model for studying the state of health of coral reefs and their biogeographical pattern, as well as the evolutionary processes linked to the relationship between form and function and the relative adaptations to colonized habitats. Furthermore, considering that the survival of many coastal human communities largely depends on tropical fish both for the supply of proteins through fishing and also from an economic point of view due to the touristic activity, the study and description of a fish community can provide useful information for the management of all human activities involving the sea, from fishing to tourism. The skills acquired in the field of fish biology and ecology can therefore be used both in the sectors related to the protection and conservation of ecosystems, in the fields of fisheries management and tourism, as well as obviously the fields of academic application.

At the end of this theoretical-practical course the student will acquire notions to:

- Identify the main families of tropical fish associated with the reef habitat
- Identify the most important fish of the Indian Ocean fauna at genus or species level.
- Examine the trophic structure of a reef fish community.
- Understand and describe the temporal and spatial variations (nyctimerial rhythms, reef zonation) of fish communities.
- List the main patterns and processes that influence the structure of a fish community.
- Investigate the impact of climate change related stressors on a fish community.
- Design and carry out visual census operations, for the study and monitoring of fish communities.
- Analyze community structure data using taxonomic and functional indices.
- Improve the statistical data analysis with the use of software.

OVERVIEW

The 9 days-workshop will take place from **23 to 31 March 2023** on Magoodhoo island, Faafu Atoll, Maldives. The logistical support base will be the Marine Research and High Education Center (MaRHE Center) of the Milano-Bicocca University (www.marhe.unimib.it). Magoodhoo and the MaRHE Center are about 3 hours by speed boat from the airport of Malé, the Maldivian capital.

The program includes daily theoretical lessons, data analysis and result presentations in the classroom, and practical activities through scuba diving in the reefs surrounding the island (1 or 2 dives/snorkeling per day). In order to carry out the practical activities, students will be divided into groups and each group will be accompanied and assisted underwater by a staff of the MaRHE Center.

The workshop will be held in English language and the lessons will be held by Dr. Davide Seveso, Prof. Giovanni Strona and Prof. Valeriano Parravicini. All activities will be coordinated by researchers from the University of Milano-Bicocca and MaRHE Center staff, who have a long experience of study and research in tropical marine environments and are expert of the coral ecosystem of the Maldives from different points of view.



Davide Seveso, marine biologist, works as Assistant Professor at the University of Milan-Bicocca, Dept. of Earth and Environmental Science (DISAT), and at the MaRHE Center since its foundation, about 12 years ago. Currently, he is also the vice-director of the MaRHE Center. His research activities are mainly related to the coral reefs of the Mal-

dives, where he analyzes the health status of corals following different environmental stress factors and their stress response from a molecular/cellular to an ecological perspective. In addition, he also investigates the ecology of other coral reef associated organisms, such as corallivorous animals. He has about 70 publications in international scientific journals plus 3 book chapters, and is a lecturer of Marine Ecology in the international master's degree course of Marine Sciences in University of Milano-Bicocca, joined with the Maldives National University. He's had multiple field experiences in the tropical marine environments of the Indo-Pacific (Kenya, Madagascar, Maldives, Indonesia, Malaysia), the Red Sea (Egypt, Saudi Arabia) and the Caribbean (Belize). He is a PADI diving instructor with an Advanced European Scientific Diver license, with more than 400 scientific dives and a total of about 900 dives.



Giovanni Strona is currently a Senior Researcher at the Joint Research Centre (JRC) of the European Commission (Ispra, Italy). He was formerly an Associate Professor in Ecological Data Sciences at the University of Helsinki (Finland), where he is still a supervisor for the PhD School in Wildlife Biology.

His research aims to identify the often underestimated role that the multiple and complex ecological interactions play in global processes of extinction. In his most recent works (published in leading scientific journals such as Nature Communications and PNAS), he demonstrated that the repeated and increasingly frequent dramatic mass mortality events of corals could lead to a 40% loss of tropical fish species. He is the author of more than 90 publications in international journals and of the book, "Hidden pathways to extinction" (<https://link.springer.com/book/9783030867638>). As a PhD student and post-doc at the University of Milan-Bicocca he assisted and contributed to the birth of the MaRHE Center, which he has actively attended in the last decade as a teacher and researcher. He is a PADI Divemaster underwater guide and a deep expert of tropical marine environments.



Valeriano Parravicini, is full professor at EPHE (Ecole Pratique des Hautes Etudes) and scientific director of the "Centre de Recherches Insulaires et Observatoire de l'Environnement" in Perpignan, France. Since 2019 he was awarded as junior member at the 'Institut Universitaire de France'. After a PhD on the effects of climatic

and anthropogenic pressures on Mediterranean rocky reef benthic communities, he obtained a post-doctoral grant at CESAB, the French Centre for the synthesis and analysis of biodiversity, based at the IRD (Institut de Recherché pour le Developpement). He develops his research around topics related to the community ecology, macroecology, functional ecology, and biogeography of coral reef communities with a special focus, but not limited to, fish assemblages. He is particularly interested in understanding the underlying mechanisms behind present biodiversity patterns, the functional organization of communities and their implication for conservation. The results of his research are published in high impact scientific journals including Science, PNAS, Current Biology, Nature Communications and Ecology Letters. He is a PADI diving instructor with more than 500 scientific dives and multiple field experiences in the Indo-Pacific.

REQUIREMENTS

The workshop is aimed at both students (enrolled in bachelor or master's degree courses or in a PhD course) and graduates preferably in the scientific field (Biology, Environmental Sciences, Natural Sciences). If the maximum limit of participants is exceeded, a selection will be performed based on applicants' experience and interests. For this reason, in the enrollment process we ask you to also submit your Curriculum Vitae and, optionally, a short motivation letter, for a possible evaluation and selection.

DIVING REQUIREMENTS

Each participant must be a **certified diver** (diving license of any level and association e.g., PADI, SSI, CMAS are accepted), **with a minimum number of 15 logged dives, or with a minimum of 10 dives of which 5 performed in the 6 months preceding the workshop.**

All divers must have a **valid diving insurance (DAN or similar)** in order to perform diving activities.

Each diver has to fill in upon his/her arrival at MaRHE Center a **medical declaration** for suitability for diving (see Appendix 1 as example). In case of positive answer to any questions, an additional medical certificate will be required to attest the suitability to diving activities. This must be obtained before travelling to the Maldives.

To carry out some practical activities it is advisable (not mandatory) to be in possession of an underwater camera and diving flashlight. Participants must bring their **own diving computer** which can't be rented on-site.

CREDITS



At the end of the workshop, all the participants will receive a certificate of knowledge of the tropical fish fauna and of the practical techniques and methodologies for the study of their ecological processes, through an International Virtual Credit called **Open Badge**, issued by the University of Milan Bicocca (See: www.openbadges.org)

and www.bestr.it/badge/show/1121). This digital certificate can be uploaded in different platforms online such as LinkedIn.

Recognition of training **credits** is foreseen for students of the International **Master's Degree in Marine Sciences (University of Milano-Bicocca)**. In particular, for these students the set of all the activities carried out during the workshop, both theoretical with lectures and elaboration and presentation of results, and practical, with field activities and data collection, can reach a number of hours equal to **4 ECTS (practical training)**.

For students of the bachelor degree in **Biological Sciences (University of Milano-Bicocca)** the recognition of **6 ECTS** is foreseen as an **internship** (not combinable with any other internships carried out in the Maldives).

Students enrolled in other degree courses and/or PhD courses and/or in other Universities or Institutions are requested to inquire at the respective administrative offices for the recognition of ECTS.

PROGRAM *

* The program may be subject to changes, due to weather conditions or other problems

DAY 1 - (March 23rd)

- Meeting at Male' International Airport and transfer by speedboat to MaRHE Center (about 2.5-3 h trip)
- Room allocation and lunch
- Introduction to the Workshop structure and MaRHE Center
- Tour of the Island
- Registration for diving activities
- Briefing on next day's activities

DAY 2 - (March 24th)

- Briefing on dive logistics and safety
- **Dive 1** - Check Dive
- Lecture 1 – Introduction to the Maldives and their coral ecosystem
- Lecture 2 – Taxonomy and identification of coral reef fish

DAY 3 - (March 25th)

- **Dive 2** - Identification of main fish families, genera and species
- **Dive 3** - Identification of main fish families, genera and species with fish catch/release
- Lecture 3 – Introduction to data analysis
- Lecture 4 – Ecological interactions and networks (1)
- Lecture 5- Coral reef fish trophic ecology



DAY 4 - (March 26th)

- **Dive 4** - Observation of trophic habits/behaviors of fish and indicator species (1)
- **Dive 5** - Observation of fish trophic habits/behaviours for the construction of ecological networks (2)
- Data analysis
- Lecture 6 – Fish visual census techniques
- Lecture 7 – Ecological interaction and trophic ecology

DAY 5 - (March 27th)

- **Dive 6 and 7** – Practice of different visual census techniques for pelagic/demersal fish in two different reef types and areas.
- Data analysis
- Lecture 8 - Ecological interactions and networks (2)
- Lecture 9 – Coral reef ecosystem functioning
- **Night Snorkeling** - Comparison of nocturnal vs. diurnal fish community composition

DAY 6 - (March 28th)

- **Dive 8 and 9** – Practice of different visual census techniques for benthic fish in two different reef types and areas.
- Data analysis
- Lecture 10 – Impact of climate change on fish communities
- Lecture 11 – Coral reef fish biogeography
- Discussion on group projects and briefing on the following day's activities

DAY 7 - (March 29th)

- **Dives 10 and 11** - Dives dedicated to collecting data for group projects
- Data analysis and preparation of project presentations
- Lecture 12 - Shark biology, ecology and physiology. Maldives sharks and rays. Identification and problems

DAY 8 - (March 30th)

- **Dive 12** – Fun dive
- Desert island excursion and lunch
- Presentation of the projects by the students, discussion of the results obtained
- Conclusion of the course and free time

DAY 9 - (March 31st)

- Preparation and departure for Male International Airport



IMPORTANT NOTES ON THE PROGRAM

- The program is indicative, as it is **subject to modifications** due to logistical needs or weather and sea conditions. In case of extreme marine conditions, diving activities could be replaced by snorkelling activities.
- The dives will be carried out both from the shore and from the boat and will be performed in different reefs located in the southern part of the Faafu Atoll at a maximum of 1 hour of navigation from the island of Magoodhoo.
- Each dive is preceded by a briefing during which the dive profile and organisation as well as the scientific activities are presented and summarised to the students.
- Each dive is followed by a substantial de-briefing and data/results/observations presentation group by group. Power point presentation can be also requested. In this regard, it is advisable to bring a personal laptop for work and analysis.
- Specific instructions on software to be installed on personal laptops to ease data analysis and exploration will be provided in detail in due time.



PRACTICAL INFO

DOCUMENTS

Travelling to the Maldives requires a passport, with at least 6 months of validity from your departure from the Maldives and at least 2 empty pages to allow the application of the local visa. If you don't have a passport, we invite you to request it promptly since the waiting time may be long. If it is necessary to speed up the release times, Italian students only can request, after registering for the workshop, a letter from MaRHE Center to be handed to the police headquarters. Please let us know if you need this.

CLOTHING

The air temperature is around 28-29°C. The weather is always pleasant, even during the rainy months. Please note that most of the day will be occupied by field activities and lectures, it is, therefore, advisable to wear comfortable sportive clothes. It is required to avoid too skimpy clothing, as the island of Magoodhoo is not a tourist destination and local costumes are those of an Islamic country.



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EQUIPMENT

For field activities it is necessary to have **your own diving equipment** and in particular:

- Mask and fins (either with or without booties)
- Wetsuit (3mm) or lycra wetsuit/shirt (water is warm, avoid 5mm or thicker wetsuits)
- Diving computer (it is mandatory to bring your own)
- BCD and regulators
- Diving flashlight and underwater camera (optional but strongly recommended)

It is **possible to rent**, for a fee and based on availability, diving equipment (BCD, fins and regulators) at the diving center of the Centre. **The dive computer is not available.**

However, we strongly recommend that you bring your own equipment which you are used to dive with and thus more confident. **Please inform us in advance in case you need to rent anything.**

ACCOMODATIONS & MEALS

The accommodation is organized at the Center, in multiple rooms (with 4 beds) with services and meals included (breakfast, lunch and dinner). Sheets and towels are provided. Each room has a private bathroom, air conditioning and a fan. The rooms are cleaned and tidied up every day. There is no accommodation in single rooms, nor in mixed rooms for boys and girls.

The food is prepared according to local customs, so it will mostly consist of fish, chicken, rice, pasta and vegetables prepared in different ways. Meals are served as a buffet. **Special dietary requirements and allergies are to be mentioned in the application form.**

HEALTH & SAFETY

No vaccination is required for travellers coming to Maldives from Europe. However, each participant should take care of this aspect in order to enter the country. In any case, it is good practice to check the coverage of the anti-tetanus vaccination, checking the expiry date. If it has expired, it can be renewed in time. Any field activity presents risks and dangers, and there are some basic rules to be observed in order to minimise them. In the water it is necessary to respect the buddy system: working groups will be settled, and, within the group, working couples will be established.

About the COVID situation, no any anti-covid swabs are required to enter the Maldives anymore.

There are some basic rules to respect once you arrive at the MaRHE Center, as indicated by the COVID safety protocol in **Appendix 2.**

INSURANCE

The insurance included with the Business Visa (for those who apply for Business Visa, see Fee & Registration chapter for more details) does not cover COVID-related costs and has a cover limit of 100.000 Maldivian Rufyiaa (MVR), approximately 6.500 USD \$, for health issues. It is, therefore, up to you to decide whether to buy private health insurance in addition to the mandatory diving insurance.



REGISTRATION & FEE

CURRENCY

The Maldivian currency is the Maldivian Rufiyaa (MVR). Euros and dollars are accepted in any bank and exchange offices. 1 Euro = about 18 Rufyiaa; 1 US \$ = about 15 rufyiaa;
It is possible to exchange money at the airport. We recommend bringing small denominations (€10 or €20), as these banknotes are also accepted also in shops on Magooodhoo Island.

COMMUNICATION

At MaRHE Center there is a free WI-FI service that can be used for educational purposes during the day and for communicating in the evenings (1-hour only). However, it is possible to purchase at the airport or in Male city a local SIM with data traffic, if you want to be always connected. Internet top-ups can be purchased online. It is now available a e-sim card on the Maldivian Ooredoo website, however compatibility with mobile phones must be verified beforehand as not all the brands and models support e-sim cards.



REGISTRATION

To proceed with the registration, you are asked to fill in the Google form which you can find at the following link:

shorturl.at/GSz48

After completing the online questionnaire through the Google form, please send an email to workshop.marhe@unimib.it specifying in the subject: "Name Surname - Fish workshop registration" and attaching

- A good quality color scan of your passport as jpg file (first 2 pages containing personal data), naming the file with FW23_Surname_Name.
- Your CV

Important: you will have to **wait for our confirmation before purchasing your flight.**

The workshop will be activated once a minimum number of participants has been reached, therefore we will give you the green light to purchase flights once this threshold is reached. Any errors you make (wrong flight dates or other) cannot be refunded. The maximum number of participants is set to 16-18 people.

**THE REGISTRATION DEADLINE IS FIXED FOR THE
10TH FEBRUARY 2023**

FEE

The registration fee for the workshop “Tropical marine fish: identification and ecology” is

€ 1,400.00

The above amount **includes**:

- Transfer by speedboat from/to Male airport
- Transfer by local boat for all the activities, dives and excursions included in the program
- Food and lodging at the MaRHE Center of Magoodhoo: full board treatment and accommodation in multiple rooms (single rooms are not available)
- Lectures and activities provided for the workshop program

The above amount **does not include**:

- Return flight to the Maldives (Male International Airport)
- Passport issuing or renewal costs, if any
- Entry visa and generic insurance coverage (if required). The cost for the VISA is €200 (detailed indications will follow)
- Rental of diving equipment (weights and weight belts are included)
- Anything else not specified above.

CANCELLATION

Following the payment of the fee, reimbursement for any cancellation will be subject to 10% admin fee.

FLIGHT TICKETS

You will be responsible for purchasing the flight. The choice of the airline is yours, the important thing is to be at the airport in Male, Maldives, on the day and at the time established (we will share with you the necessary information once registered). Pay attention while purchasing the flight tickets as your mistakes (incorrect flight dates or other) cannot be reimbursed. Furthermore, it will be necessary to send us by mail (workshop.marhe@unimib.it) a copy of the air ticket to be able to proceed, if necessary, with the entry visa request, which we will take care of.



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Appendix 1

MEDICAL STATEMENT

Please carefully read the medical statement which you will need to fill only once on the island of Magoodhoo. Should you reply YES to any of the questions, you are required to present a medical certificate following a Physical Examination by your physician. This must be obtained before travelling to the Maldives.

The purpose of this Medical Questionnaire is to find out if you should be examined by your doctor before participating in recreational diving. A positive response to a question does not necessarily disqualify you from diving. A positive response means that there is a preexisting condition that may affect your safety while diving and you must seek the advice of your physician prior to engaging in dive activities. Please answer the following questions on your past or present medical history with a **YES** or **NO**. If you are not sure, answer **YES**. If any of these items apply to you, we must request that you consult with a physician prior to participating in scuba diving. Your instructor will supply you with an RSTC Medical Statement and Guidelines for Recreational Scuba Diver's Physical Examination to take to your physician.

- Could you be pregnant, or are you attempting to become pregnant?
- Are you presently taking prescription medications? (with the exception of birth control or anti-malarial)
- Are you over 45 years of age and can answer YES to one or more of the following?
- Currently smoke a pipe, cigars or cigarettes
 - Have a high cholesterol level
 - Have a family history of heart attack or stroke
 - Are currently receiving medical care
 - High blood pressure
 - Diabetes mellitus, even if controlled by diet alone
- Have you ever had or do you currently have...**
- Asthma, or wheezing with breathing, or wheezing with exercise?
- Frequent or severe attacks of hayfever or allergy?
- Frequent colds, sinusitis or bronchitis?
- Any form of lung disease?
- Pneumothorax (collapsed lung)?
- Other chest disease or chest surgery?
- Behavioral health, mental or psychological problems (Panic attack, fear of closed or open spaces)?
- Epilepsy, seizures, convulsions or take medications to prevent them?
- Recurring complicated migraine headaches or take medication to prevent them?
- Blackouts or fainting (full/partial loss of consciousness)?
- Frequent or severe suffering from motion sickness ?
- Dysentery requiring medical intervention?
- Any dive accidents or decompression sickness?
- Inability to perform moderate exercise?
- Head injury with loss of consciousness in the past 5 years?
- Recurrent back problems?
- Back or spinal surgery?
- Diabetes?
- Back, arm or leg problems following surgery, injury or fracture?
- High blood pressure or take medicine to control blood pressure?
- Heart disease and/or attack?
- Angina, heart surgery or blood vessel surgery?
- Sinus surgery?
- Ear disease or surgery, hearing loss or problems with balance?
- Recurrent ear problems?
- Bleeding or other blood disorders?
- Hernia?
- Ulcers or ulcer surgery ?
- A colostomy or ileostomy?
- Recreational drug use or treatment for, or alcoholism in the past 5 years?

The information I have provided about my medical history is accurate to the best of my knowledge. I agree to accept responsibility for omissions regarding my failure to disclose any existing or past health condition.

Date:

Signature:

Appendix 2

COVID-19 Health and Safety Protocol

Safety measures at MaRHE Center

- It is recommended to wear face masks correctly in the **Center classroom**
- Hand hygiene: hand washing should occur after touching anything, after using the restroom, prior to eating, and after touching one's face or blowing one's nose.
- It is recommended to possess adequate health insurance

Testing and positive cases

Individuals with concerning symptoms will be tested by the local doctor (rapid antigen test) for Covid-19.

Individuals who test positive for Covid-19 will have to abide by the Maldivian HPA protocol, which is constantly evolving.

A MaRHE Center staff member will remain on the island so long as anyone is subject to isolation. All medical and logistical costs incurred by the person who tested positive for Covid-19 are his/her responsibility.

Please note that Covid-19 rules could change through time due to the global health situation, which is constantly evolving.

MaRHE Center Director

A handwritten signature in black ink, appearing to read "Abdullah".

