

**MOL (Mitsui OSK Lines) Mauritius International Fund for Natural
Environment Recovery and Sustainability
Brief Report of Activities during 2025 fiscal year**

**Joint project with:
The University of Mauritius and
The Biodiversity and Environment institute (NGO)**

Title of the Project

**A scientific approach for the conservation and restoration of
Mauritius Coral Reefs under the combined effects of climate change
and marine pollution**

**Principal Investigator: Beatriz Estela CASARETO,
Prof. Emeritus, Shizuoka University; Senior Researcher, Marine Learning Center;
and**

Guest Professor, Museum of Natural and Environmental History, Shizuoka

Content of this report

(1) Activities during fiscal year 2025

(2) Activities during the SU team visit to Mauritius in collaboration with UoM and BEI.

(2-1) Visit the Japanese Ambassador's Residence and the MOL office in Mauritius.

(2-2) Joint field surveys at Belle Mare , Ile d'Ambre, and Grand Gaube reefs

- * Sampling of selected corals for measurements of their physiological parameters
- * physico-chemical parameters of the water including nutrients, organic matter, light intensity, temperature and salinity
- * Biological parameters including photosynthetic pigments, pico-nanoplankton, phytoplankton and zooplankton

(2-3) Coral Incubation Experiments to test physiological responses under heat stresses

- * Incubations objectives, targeted corals, set-up and methods
- * Some outputs from the coral experiments

(2-4) Capacity Building: Scientific and Social Impact

- * Workshop on “Coral Reefs and Ocean Warming” (CROW2025) on October 15, 2025,
Venue: **University of Mauritius** (Pole of Research Excellence-Sustainable Marine Biodiversity and Dept. of Biosciences
& Ocean Studies, Faculty of Science)
- * TV interviews and newspaper articles.
- * Scientific publications and presentations at International Symposia

Activities during 2025 fiscal year

From April to June 2025

- field surveys to evaluate coral bleaching rates as a consequence of a strong heat wave during the summer of 2025.
- Field surveys in Belle Mare for the completion of taxonomic identification of organisms summarized in the handbook “Biodiversity in Belle Mare”
- Online discussion for the preparation of abstracts to attend the 13th WIOMSA (Mombasa, Kenya)
- Online lectures: (1) Coral physiological responses to stress; (2) coral bleaching mechanism

From July to August:

- Field surveys to evaluate corals’ recovery rates after the bleaching event during summer
- Preparation of abstract for the 28th Annual Meeting of the Japanese Coral Reef Society (Okinawa, Nov 29-Dec 1)
- Online lecture on pico-nanoplankton and its role in the microbial loop of coral reefs

From September to October:

- UoM and BEI attended the 13th WIOMSA with presentations.
- SU team to visit Mauritius (see schedule in next page)

From November to December:

- SU team attended the 28th JCRS with presentations
- Treatment of samples collected during the SU team visit to Mauritius.
- Online discussion and submission of abstracts to attend the 16th ICRS (New Zealand)

From January 2025 to March 2026:

- Data analysis and preparation of reports.

Visit the Japanese Ambassador Residence and the MOL office in Mauritius

1) Visit the Japanese Embassy, Ambassador's residence for dinner on October 8, from 18:30~

We discussed activities during our visit to the Republic of Mauritius in October 2025, and explained in detail our schedules to his excellence the Japanese ambassador Mr. Masahiro KAN.



At the Japanese ambassador' residence the SU and UoM team members
Join the Japanese Ambassador Mr M. Kan and the First secretary Mrs Nakamura

2) Visit to MOL office on October 9 from 16:00~

We visited MOL office, discussed and explained in detail planned activities during our visit to the Republic of Mauritius in October 2025, including filed trips and experiments. We invited to Mr. Y. Suzuki and Mr. K. Sohun to participate in our filed trips with the aim to more clearly understand our activities and efforts during field sampling.

We also discussed the necessity to continue these research activities in searching heat tolerant corals and, on the contrary, those corals that are weak to environmental changes, for further restauration and resilience of the coral reefs around Mauritius under the global climate change scenario. We strength the idea that during previous years we focused on field surveys, but from now we are shifting to laboratory experiments to test the adaptation capacity of some selected corals in Mauritius to heat waves that are recently observing in Mauritius reefs causing extended bleaching effects on some coral species.

Joint Survey (SU, UoM and BEI) at Belle Mare on October 10, 2025



Plankton sampling



Coral sampling



Aspect of coral colonies at BM1



Sensors for temp. Salinity and light

Joint Survey (SU, UoM and BEI) at Ile d'Ambre and Gran Gaube on October 12, 2025



Styllophora madagascarensis.



Pavona decussata



Some members of UoM and SU during Joint survey at Ile d'Ambre

We measured in situ parameters as water temperature and light intensity using in situ loggers.

We took water samples for nutrients, organic matter, and plankton analysis. We sampled several coral species for further incubations under stress conditions.

Coral incubation experiments to test coral physiological responses under thermal stress at 30°C and 33°C (maximum temperature during summer bleaching event)

Objectives:

- 1) to assess physiological responses of selected corals under normal and stressful conditions (high seawater temperature of 30 °C)
- 2) To evaluate corals primary productivity under normal vs. stressful conditions

Target corals:

a) Incubation at 30 °C stress

7 species from Belle Mare reef: *Pocillopora damicornis*, *Pocillopora eydouxi*, *Pavona decussata*, *Fungia sp.*, *Galaxea sp.*, *Acropora muricata*, *Acropora tabular*

3 species from Ille D'ambre: *Stylophora madagascarensis*, morpho-1, morpho-2, and morpho-3

1 species from Grand Gaube: *Stylophora madagascarensis* morpho-5 (3 different colonies);

b) Incubation at 33 °C stress

6 species from Grand Gaube: *Pavona decusata*, *P. cactus*, *P. frondifera*, *P. danae*, *Galaxea spp*, *Fungia spp*.

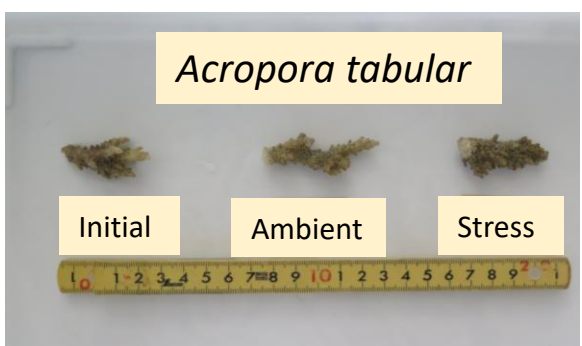
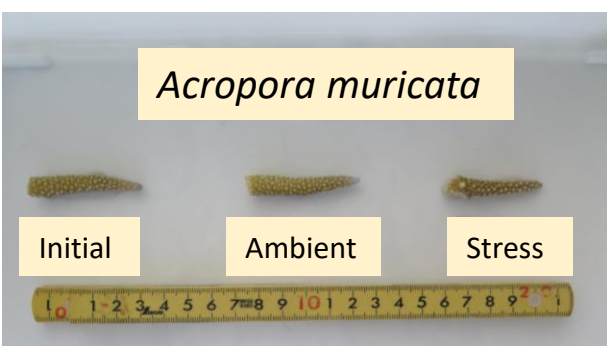
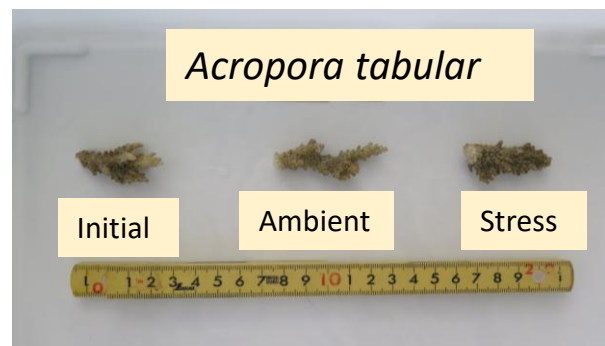
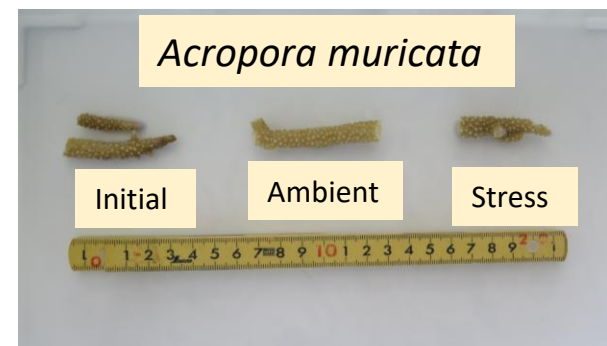
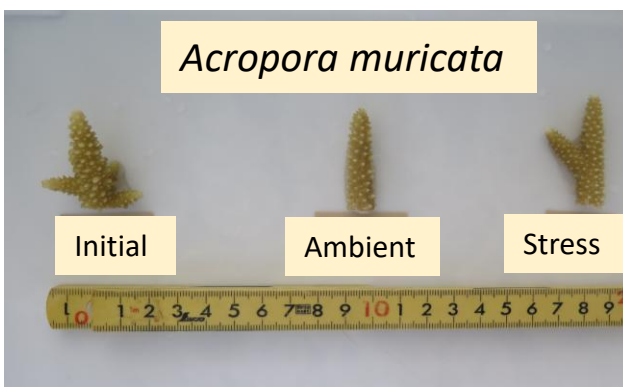
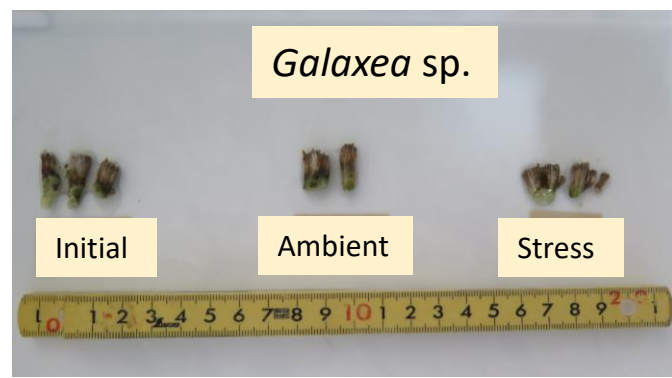
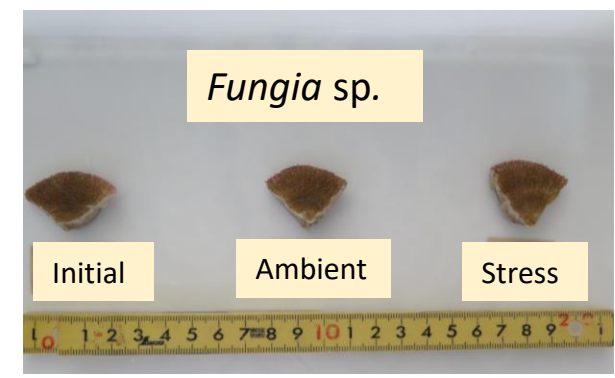
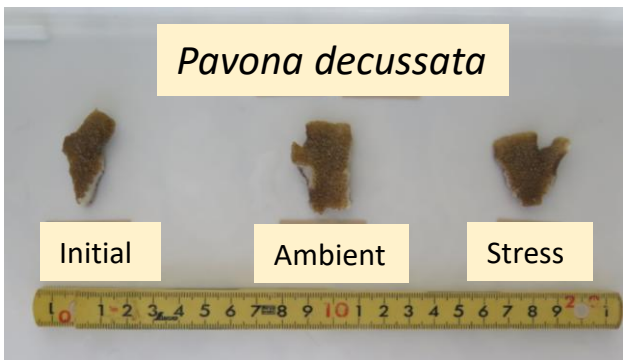
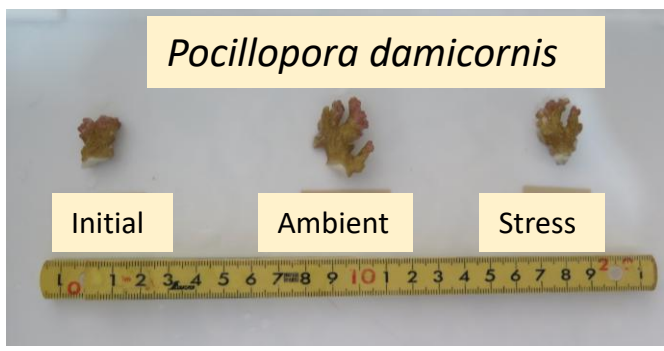
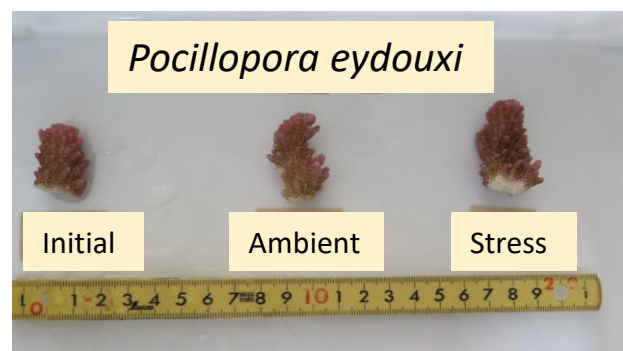
Experiment set-up:

Corals were incubated under ambient (24°C) temperature or stress temperature (30°C or 33 °C) for 4 hours. For 33°C corals were preadapted in a temperature ramp-up incubation period of 45 hs.

Measurements:

- * **Continuous monitoring of light and temperature in the incubation chamber.** * **Coral incubated waters:** Dissolved oxygen, pH and nutrients
- * **Coral tissues:** zooxanthellae density, primary productivity, photosynthetic pigments, hydrogen peroxide scavenging activity (HPO), glucose and glycerol concentrations and ratios.

Example of heat stress experiment (corals from Belle Mare)



Aspect of incubations

Stn. BM1

Stn. BM2

Stn. BM3

Some outputs from field surveys and coral incubation experiments

As same as in Belle Mare, in IA and GG reefs, runoff of nitrogen-reach fertilizers can be assessed from the high concentrations of nitrate and ammonia resulting in high N/P ratios. Inflow of fresh water can also be observed from the low salinity values in Ile d'Ambre.

In these reefs, water transparency is lower than in Belle Mare, and this pattern also matches with higher particulate organic carbon and nitrogen (POC and PON), indicating more available organic matter that could serve as food for the coral community

Corals from the Family Pocilloporidae (*Pocillopora* sp., *Stylophora* sp.) showed a good performance to fight heat stress by rapidly responding to the apply stresses, with the production and consumption of antioxidants to prevent damage from ROS formation. Moreover, replacing Glucose by Glycerol was another physiological feature that helped the corals to stabilize cell-osmotic pressure disbalance and protect their photosystem inside the zooxanthellae cells.

Another important physiological strategy to reduce oxidative stress is the rapid degradation of free Chlorophylls into **CPE**, which is non-fluorescent and therefore ROS formation can be dramatically reduced. This pattern was particularly evident in *Stylophopra* and *Pavona* corals from GG field.

Acropora corals were weak against heat and strong illumination stresses, and almost all the study colonies showed negative values of primary production under thermal stress. However, it seems that there are wide differences among colonies and their responses to stressors; an example was the *A. muricata* from stn. BM2: This coral colony showed a high antioxidant enzyme production during heat stress and a low Glucose/Glycerol ratio, exemplifying a positive response to fight against the effects of ROS during heat stress.

The observed SST during the extended bleaching event in 2025 summer, inspire the experiment applying 33 °C of heat stress with the aim to more understand the corals responses: in this experiment we wanted to test corals from the genus *Pavona* that showed lower bleaching rates and good recovery. The result of our incubation showed that these corals kept high primary production rates reflected also in their high Chl *a* content. Also, they showed the pattern of degrading Chl *a* into CPE to avoid damage from ROS formation in their zooxanthellae and tissues. This confirm our assumption that *Pavona* corals must be considered as heat-resistant and need to be considered in future strategies of reefs recovery in Mauritius.

Capacity Building: scientific and Social Impact

Workshop organized in collaboration among SU, UoM, BEI, MOL, Odysseo and SECORE



University of Mauritius

(Pole of Research Excellence-Sustainable Marine Biodiversity and
Dept. of Biosciences & Ocean Studies, Faculty of Science)

Shizuoka University, Japan

UoM & Odysseo Marine Station for C2RE
& SECORE International Ltd

In collaboration with The Biodiversity and Environment Institute and with
support of Mitsui O.S.K. Lines Ltd

Workshop on

“Coral Reefs and Ocean Warming” (CROW2025)

Wednesday, 15 October 2025 at 09:00

Venue: LT2, NAC, Reduit, UoM

Proposed programme:

Time	Speaker	Title
08:30-09:00	Registration	
09:00- 09:05	Dr D Kaullysing / Prof R Bhagooli	Welcome Address
09:05-09:20	Assoc. Prof. Preethee GONPOT, Dean of Faculty of Science, UoM	Address from UoM
09:20-09:35	Mr Yasuo SUZUKI, Managing Director, MOL (Mauritius) Ltd	Address from MOL Ltd
09:35-09:50	His Excellency, Mr Masahiro KAN Ambassador Extraordinary and Plenipotentiary of Japan to the Republic of Mauritius	Opening Address (TBC)
09:50-10:10	Hon. Dr. Kaviraj Sharma Sukon, Minister of Tertiary Education, Science & Research	Opening Address (TBC)
10:10 – 10:35	Prof. BE Casareto, Shizuoka University, Japan	Coral thermal stress responses
10:35 – 10:55	Prof. Y Suzuki, Shizuoka University, Japan	Impact to carbon cycle in the coral reefs by ocean warming and acidification : Fate of CO ₂
10:55 – 11:15	Health Break	Light Refreshment
11:15 – 11:30	Dr M Miller (SECORE Ltd)	How Coral Larval Propagation and Seeding Can Buffer Coral Reef Damage from Ocean Warming
11:30 – 11:45	Dr G Quéré (SECORE Ltd & Odysseo Foundation)	Coral Larval Seeding for Reef Restoration in Mauritius: Insights from the Project's First Year
11:45-12:00	MT Illing, Stanford University, USA	Reconstructing Indian Ocean climate change from Mauritius corals
12:00- 12:10	Prof R Bhagooli & Dr D Kaullysing (UoM)	Some insights on coral Bleaching events at Grand Gaupe, Mauritius
12:10 – 12:20	Dr A Gopeechund (BEI) / Prof R Bhagooli (UoM)	Marine Biodiversity of Belle Mare
12:20- 12:30	Dr D Kaullysing (UoM)	Question and Answers
12:30 – 12:35	Dr D Kaullysing (UoM)	Closing remarks

Workshop organized in collaboration among SU, UoM, BEI, MOL, Odysseo and SECORE

The main aim was to disseminate research findings from Shizuoka University (SU), the University of Mauritius (UoM), and the Biodiversity and Environment Institute (BEI) under the MOL Mauritius International Fund Project. We wanted to raise awareness among stakeholders on coral reefs of Mauritius, thermally resilient corals to global warming, and how best they can be conserved, protected, and managed in an era of global warming. The workshop is very timely, given the increase of warming-induced mass bleaching events in the region. The targeted audience was the UoM Marine Science and Coastal & Ocean Management Students, and Relevant stakeholders.

The workshop was held in the presence of the Ambassador of Japan to the Republic of Mauritius Mr. Masahiro KAN, and Mr Yasuo SUZUKI, Managing Director of MOL (Mauritius) Ltd. The opening address was given by Assoc. Prof. M.I. SANTALLY, Dean of the Faculty of Science, UoM. We got the participation of around 90 people, including professors and authorities from UoM, authorities from the Japanese embassy in Mauritius, members of the MOL office in Mauritius, members of the Odysseo aquarium, other stakeholders, NGOs, and students. Media communicators were also present (Le Mauricien Newspaper and the National TV channel)



Authorities introducing the workshop and its importance: Prof M.I. Santally (UoM Vice chancellor), Mr. M.Kan (Japanese Ambassador in Mauritius), Mr Y Suzuki (Gen. Manager MOL) Prof. Ranjeet Bhagooli (UoM) and Prof B.E. Casareto (SU)



Scientific presentations by Prof B.E. Casareto and Prof. R Bhagooli



Group photo with participants

Publications and presentations at International Symposia

Published papers

Mattapullut B., Anasamy M., Jogee Y. S., Korimbocus A., Maukshada R., Kaullysing D., Casareto B.E., Suzuki Y., Agus A. H., Jue A. A. L., Reimer J. D., Bhagooli R. (2025): A first preliminary study of on the Gorgonians (Octocorallia) around Rodrigues Island, Western Indian Ocean, and factors influencing their distribution. **Indo-Pacific Journal of Ocean Life. *Special Issue on Marine Studies from Rodrigues Island, Western Indian Ocean***

S. Y. JOGEE, M. ANASAMY, S. JEETUN, M. RICOT, M. RAMKALAM, AS. KORIMBOCUS, D. KAULLYSING, B. NASCIMENTO, B. E. CASARETO, Y. SUZUKI, D. P. WIJAYANTI, R. BHAGOOI (2025): Coral diseases and associated photosynthetic responses around Rodrigues Island, Western Indian Ocean. **Indo-Pacific Journal of Ocean Life. *Special Issue on Marine Studies from Rodrigues Island, Western Indian Ocean***

MATTAPULLUT B., ANASAMY M., JOGEE Y. S., KORIMBOCUS A., ROUSSETY A. M., BHUROSAN H., MAUKSHADA R., KAULLYSING D., CASARETO B. E., SUZUKI Y., AGUS A. H., JUE A. A. L., J. D. REIMER, D. P. WIJAYANTI, B. NASCIMENTO, BHAGOOI R. (2025): First record of *Annella mollis* (Octocorallia) from Rodrigues Island, Western Indian Ocean. **Indo-Pacific Journal of Ocean Life. *Special Issue on Marine Studies from Rodrigues Island, Western Indian Ocean***

M. K. RAMKALAM, A.M. KORIMBOCUS, SHAKEEL Y.J., F.GERZER, Y. NUNDLALL, D. CHATOOLSINGH, M. ANANSAMY, D. KAULLYSING, B. E. CASARETO, Y. SUZUKI, J. REIMER, D. PERMATA WIJAYANTI, B. NASCIMENTO, R. BHAGOOI (2025): Distribution and photo-physiology of bleached and non-bleached *Sarcophyton* sp. In Rodrigues reefs, Republic of Mauritius. **Indo-Pacific Journal of Ocean Life. *Special Issue on Marine Studies from Rodrigues Island, Western Indian Ocean***

Yashvi N., Marwyn A., Shakeel Y. J., Ricot M., Maukshada R., Ashfaaq M. K., Dawosing C., Deepeeka Kaullysing D, Jean M., Perrine S. , Nascimento B., Casareto B. E. Suzuki Y, Mironenko G. C. , Kondo K. C. F., Reimer J. D. , Bhagooli R.: Density distribution and photo-physiological responses of the sea anemone *Radianthus magnifica* around the east of Rodrigues Island, Western Indian Ocean. **Accepted for publication at Galaxea, Journal of the Japanese Coral Reef Society**

Publications and presentations at International Symposia

Participation in Symposia:

13th WIOMSA Symposium: *"One Ocean, One Future: Connecting People, Policy, and Science for a Thriving Western Indian Ocean."* Sept-Oct 2025, Mombasa, Kenya

- Ranjeet Bhagooli, Maukshada Kamakshi Ramkalam, Sruti Jeetun, Shakeel Y Jogee, Melanie Ricot, Muhammad Ashfaaq Korimbocus, Anasamy Marwyn, Yoshimi Suzuki, Beatriz Estela Casareto, Deepeeka Kaullysing: Variable bleaching resistance over three bleaching events: management and restoration implications
- Deepeeka Kaullysing, Yoshimi Suzuki, Beatriz Estela Casareto, Ranjeet Bhagooli: High *Drupella* density around Mauritius - A proposed Response Plan to combat outbreaks

28th Annual Meeting of the Japanese Coral Reef Society (Okinawa, Nov 29)

- CASARETO Beatriz, SUZUKI, Yoshimi, TOYODA Keita, BHAGOOI, Ranjeet, KAULLYSING Deepeeka, JORGEE Shakeel Y, JEETUN Sruti, RICOT Melanie, GOPEECHUND Arvind: A scientific approach for the conservation and restoration of Mauritius Coral Reefs under the combined effects of climate change and marine pollution.

submitted abstracts for 2026 ICRS Symposium, 19–24th July 2026, Auckland, Aotearoa New Zealand.

Variable resilience of corals to marine heatwaves and potential of *Pavona* as a dominant species on future reefs

Maukshada Kamakshi Ramkalam , Ashfaaq Muhammad Korimbocus, Shakeel Yavan Jogee , Sruti Jeetun , Marwyn Anasamy , Deepeeka Kaullysing , Yoshimi Suzuki, Beatriz Estela Casareto, Ranjeet Bhagooli

First report and photo-physiology of the deepest mesophotic coral, *Leptoseris* sp., from the Indian Ocean

Ranjeet Bhagooli, Maukshada Ramkalam, Ashfaaq Korimbocus, Sylvio Perrine· Peter Psomadakis, Deepeeka Kaullysing, Beatriz Estela Casareto, Yoshimi Suzuki

Differential thermal photo-physiological vulnerabilities of a coralline red alga, a gorgonian and a reef-building coral from the Saya de Malha, Indian Ocean

Ranjeet Bhagooli, Deepeeka Kaullysing, Sundry Ramah, Vikash Munbodhe, Mariette Dine-Ogale, Maukshada K Ramkalam, Ashfaaq M Korimbocus· Beatriz Estela Casareto, Yoshimi Suzuki

Comparative Assessment of Microbial Plankton Dynamics and Coral Reef Resilience Between Eastern and Western Reefs of Mauritius Island

Ashfaaq Muhammad Korimbocus, Maukshada Kamakshi Ramkalam, Shakeel Yavan Jogee, Marwyn Anasamy, Deepeeka Kaullysing, Yoshimi Suzuki, Beatriz Estela Casareto, Ranjeet Bhagooli

Social Impact

MBC 1 TV news interviewed Prof. R. Bhagooli and Prof. B E. Casareto regarding the status of coral reefs in Mauritius: In recent years, reefs in Mauritius faced extended bleaching events, but good recovery of some coral species was observed. Those heat-resistant corals (super corals) are very important components of Mauritius reefs for the resilience of future reefs in Mauritius. The discussion focused on the conservation of super corals as well as those corals with low adaptation capacity to heat stress, particularly the very valuable endemic corals in the Mauritius reefs.



Newspaper article Le Mauricien, October 17, 2025

Les enjeux des récifs coralliens et du réchauffement des océans

L'Université de Maurice a accueilli mercredi un atelier de haut niveau intitulé *Coral Reefs and Ocean Warming* (CROW2025), consacré aux enjeux cruciaux liés à la préservation des récifs coralliens face au réchauffement climatique. L'événement dirigé par le Pr Ranjeet Bhagooli et la Dr Deepeeka Kaulysing, du Pôle d'Excellence en recherche sur la biodiversité marine durable et de la faculté des sciences de l'Université de Maurice, s'est tenu au *Lecture Theater 2* (LT2) du campus de Réduit.

Ils ont bénéficié du soutien de l'Université de Shizuoka (Japon), de l'Université de Maurice & *Odysseo Marine Station for Coral Conservation Research and Education* (C2RE), de la *Sexual Coral Reproduction* (SECORE) *International Ltd*, ainsi que du *Biodiversity and Environment Institute* (BEI) et de la *Mitsui O.S.K. Lines Ltd*.

L'objectif principal de cette rencontre scientifique était de présenter les résultats récents des travaux de recherche menés dans le cadre du MOL Mauritius International Fund Project. Les chercheurs de l'Université de Maurice, de la *Shizuoka University* et du BEI, en collaboration avec des experts de la *Stanford University* (États-Unis) et de *SECORE International Ltd*, ont partagé leurs découvertes sur les récifs coralliens mauriciens

et les coraux présentant une résistance thermique face au réchauffement global. À travers des présentations et des échanges interactifs, les intervenants ont insisté sur la nécessité de mieux comprendre, conserver et gérer les écosystèmes coralliens, véritables trésors de biodiversité marine, mais particulièrement vulnérables aux changements climatiques. En effet, selon les participants de l'atelier, les récifs coralliens jouent un rôle écologique et économique majeur. Ils abritent plus d'un million d'espèces marines et soutiennent les moyens de subsistance de centaines de millions de personnes. Leur valeur économique est estimée à plusieurs centaines de milliers de dollars américains par hectare chaque année.

Pourtant, ces écosystèmes

sont aujourd'hui gravement menacés par le réchauffement climatique et la multiplication des vagues de chaleur marines. Cet atelier a également permis de sensibiliser les parties prenantes locales, notamment les chercheurs, étudiants, décideurs et acteurs du secteur marin sur l'importance d'une coopération internationale pour la préservation durable des récifs coralliens.

Par ailleurs, l'objectif de cette rencontre était clair, soit de mieux comprendre les impacts des vagues de chaleur marines sur le blanchissement et la mortalité massive des coraux, tout en explorant de nouvelles méthodes de restauration et de conservation. Les scientifiques ont rappelé que la planète a franchi, en juillet 2023, la limite critique de +1,5 °C fixée par l'Accord de Paris, entraînant des épisodes de mortalité corallienne sans précédent et compromettant une décennie d'efforts de restauration.

Parmi les intervenants de renom figuraient la Pr Beatriz Casareto et le Pr Yoshiaki Suzuki de la *Shizuoka University*, partenaires de longue date de l'Université de Maurice depuis 2008, qui ont présenté leurs dernières recherches sur la résistance thermique des coraux. La Dr Margaret Miller et la Dr Gaëlle Quéré, de *SECORE International Ltd* et de la *Fondation Odysseo*,

ont quant à elles exposé les avancées prometteuses sur la propagation larvaire et la régénération naturelle des coraux, notamment à partir d'expériences menées à Maurice.

Par ailleurs, Matthew Illing, de l'Université Stanford (États-Unis), a présenté ses travaux sur la reconstruction du changement climatique à partir des coraux mauriciens, tandis que le Professeur Bhagooli a dévoilé des données locales inédites montrant la résilience variable de 18 espèces coralliennes face aux épisodes de blanchissement enregistrés en 2016, 2019 et 2025. Finalement, le Dr Arvind Gopeechund, du *Biodiversity and Environment Institute*, a profité de l'occasion pour lancer un livret sur la biodiversité marine de Belle-Mare, destiné à sensibiliser le grand public sur la préservation du patrimoine marin mauricien.

En croisant ces approches scientifiques, les chercheurs envisagent désormais une stratégie intégrée de restauration, de conservation et de gestion durable des récifs coralliens, pierre angulaire d'une économie bleue régénératrice. Dans un contexte où les océans se réchauffent plus vite que jamais, cet atelier marque une étape décisive dans la mobilisation des savoirs pour préserver l'un des écosystèmes les plus précieux de notre planète.

