IMA NEWS

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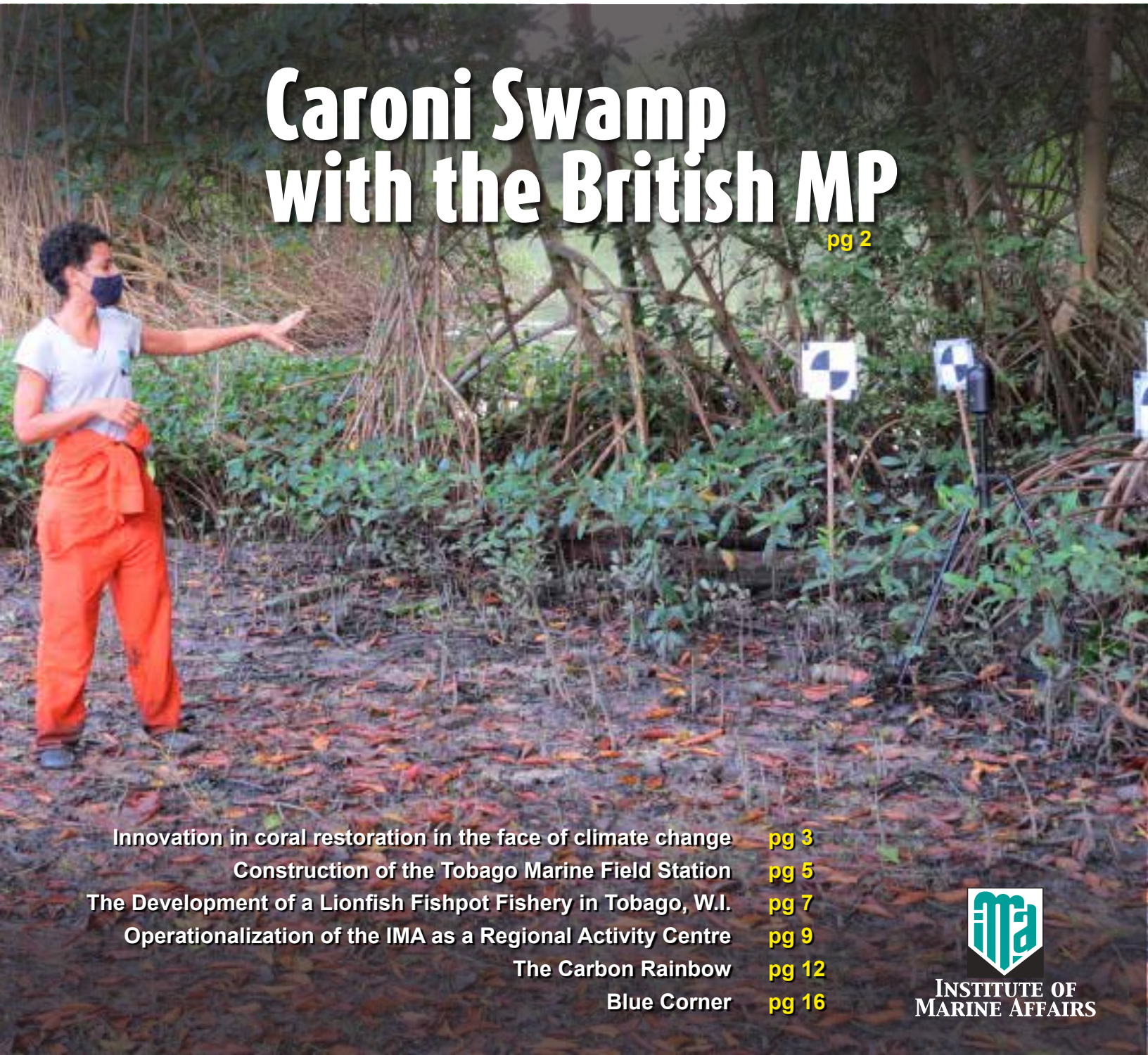

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INSTITUTE OF MARINE AFFAIRS

Caroni swamp with the British MP: Carbon storage capacity of mangrove forests in the region

Nations of the world gathered in Glasgow, United Kingdom (UK) for the 26th United Nations Climate Change conference, also known as COP26 from 31 October to 12 November 2021. This conference was of particular importance since it was the first time since the 2015 Paris Agreement (COP21) that parties were expected to commit to increased reductions in greenhouse gas (GHG) emissions; a commitment required of nations every 5 years.

In preparation for this meeting, earlier in 2021, the Right Honourable Anne-Marie Trevelyan, a UK Member of Parliament (MP) and Secretary of State for International Trade and International Champion on Adaptation and Resilience for the COP26 Presidency visited the Caribbean region ahead of COP26 to garner support for the summit. The British MP's portfolio included responsibility for carbon budgets and green financing, so the work being conducted jointly by the Institute of Marine Affairs and the University of the West Indies on the carbon storage possibilities of mangrove forests is of special interest.

The British High Commission (BHC) is currently funding a study to determine the carbon storage capacity of mangrove forests in the region. Mangrove forests store more carbon per hectare than regular forests. From December 2019 to May 2020, the BHC provided funding to the University of the West Indies' (UWI) St Augustine Centre for Innovation and Entrepreneurship (STACIE) which collaborated with the IMA to use a terrestrial laser scanner to recreate the tree in 3D in a digital environment in order to develop improved estimates of carbon in individual mangrove trees in Trinidad and Jamaica. Subsequently the BHC provided funding to the IMA to conduct an assessment of mangrove soil carbon in Guyana, Suriname and Trinidad and Tobago. With robust and accurate assessments of the aboveground and belowground carbon in mangrove forests, proper protection and monitoring, and reporting and verification measures put in place, Trinidad and Tobago could potentially be paid to keep mangrove forests intact through the United Nations Reducing Emissions from Deforestation and Forest Degradation (REDD+) programme.

On 2 September 2021, The Right Honourable Anne-Marie Trevelyan joined Her Excellency Harriet Cross, the United Kingdom High Commissioner to Trinidad and Tobago, and other delegates from the BHC to witness first hand research activities at the Caroni Swamp (the largest mangrove forest in Trinidad and Tobago, and a Ramsar Site). Fieldwork activities undertaken for the two mangrove carbon projects funded by the BHC were demonstrated by IMA researchers. This included the use of the terrestrial laser scanner for improving carbon estimates of mangrove trees, and soil coring for the mangrove soil carbon assessment. The Minster said "It's been an absolute privilege to come here and see for myself the work that's going on to understand in much more depth the importance of the mangrove. One of the challenges we've had as part of our climate change mission to get back on track is both to protect what we have and to understand it better. The mangrove is one of the best sources of holding carbon, and we need to make sure to protect those that are there and to replant more, so this is a really exciting project." The UK Minister tour of the site ended with the delegation witnessing the roosting of the Scarlet Ibis and other birds at the Swamp.

Innovation in coral restoration in the face of climate change

Diving at coral out planting site. Photo by Anjani Ganase

Coral reefs face a certain future of loss in the face of climate change based on observable trends and the future temperature trajectory. “1.5 C to stay alive” is no joke when it comes to coral reefs, an ecosystem that has already been devastated by coral bleaching at global scales. The Intergovernmental Panel on Climate Change Special Report (2018) projects an increase in temperature of 1.5 °C will destroy 70 – 90 % of coral reefs, and beyond this, coral reefs will no longer exist in the way we know them. At the recent COP26 in Glasgow, global leaders discussed the ambitious task of committing to “net zero by mid-century and to keeping 1.5 degrees within reach.” Globally, this means that we may avoid enormous loss for many ecosystems around the world, but it will still be devastating to coral reefs that are already feeling the heat.

In Tobago, we have lost an average of 50 % of hard coral cover during a single bleaching event in 2010, ten years ago with minimal recovery to date. For Trinidad and Tobago and the many nations in the Caribbean that depend on these marine ecosystems for their livelihoods, there is an urgent need to actively protect and manage our coral reefs, while at the same time, arming ourselves with the tools to maximise coral survival and recovery through restoration. At the IMA our role is to research all avenues for the suitable applications of coral restoration.

It is apt that while the COP26 discussions were taking place, the IMA took part in a coral restoration workshop in Curaçao hosted by SECORE International for four Caribbean countries: Belize; St Barth; Guadeloupe and Trinidad and Tobago.

This workshop focused on larval-based restoration techniques to maximise coral reproductive success and to maintain diversity of the coral offspring that is crucial for building natural resilience to the shifting climate. The development of such methods is not simple and requires dedicated research into the reproductive and survival strategies of coral species. This has been the role of SECORE International over the past ten years (at least!). SECORE aims to create and share the tools and technologies for sustainable coral reef restoration. They focus on maximising the success of breeding corals with minimal tools or without the need for laboratories or land-based facilities. One of the assumptions is that countries most vulnerable to climate change, Small Island Developing States (SIDS), are also at high risk of losing their coral reefs and face a rising tide of economic expenses to mitigate the impacts of climate change.

Over ten days, conservationists and scientists from the four nations gathered at the CARMABI Research Station in Curaçao. The members of the group had varying levels of experience in coral reef ecology, conservation and restoration. The formal training meant long days with classroom and lab sessions during the day to understand coral biology and preparations needed to rear corals outside their natural habitat. Our mornings were spent previewing ten plus years of research that supported the methods we were adopting today. The fundamentals of the restoration encouraged us to think like corals and understand what they need to survive. We considered the practical little things, such as their water and light conditions, and no bug spray or sunscreen in the lab; but also the bigger

Team photo in Curaçao including Coral Reef Ecologist, Anjani Ganase, and marine trainee, Hannah Lochan, representing the IMA. Photo by SECORE International

understanding of our limits - don't be too greedy when collecting coral gametes and never place your eggs in one beaker (or fat separator!). These were the strategies for maximising breeding success.

We also learned about the technologies for coral seeding and rearing in the lab and in holding pens, floating containers known as CRIBs (Coral Rearing In-situ Basin). Seeding units - artificial substrates that mimic the reef - are used for the settlement of the coral larvae before placing them out on the reef. The SECORE unit has gone through many iterations over the years for maximising coral survival and minimal maintenance on the reef.

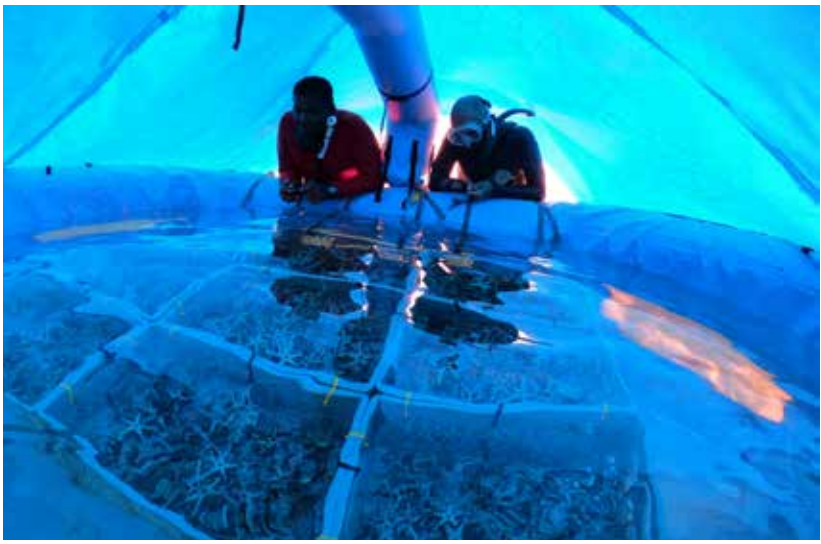
At night is when the coral magic happens. Every evening we would dive a nearby coral reef called the Water Factory, which is adjacent to one of the oldest and largest desalination plants on the island. Theory has it that the corals at this site may have adapted to tolerate the warm water discharges of the factory. Not a bad choice for gametes, if we want corals to become more thermally tolerant to warming oceans. Every evening we dived the reef to observe the spawning of three coral species – boulder brain coral *(Colpophylia natans)*, the symmetrical brain coral *(Pseudodiploria strigosa)* and the massive starlet coral *(Siderastrea siderea)*. The timing of their spawning events is already well known in this region from years of observational work.

When coral spawning happens, our job begins. We trap the gametes in tubes attached to conical nets draped over the coral colony. We then bring the gametes back to the lab where we cross fertilise among all the collected colonies. After, all the unfertilised gametes are removed and returned to the sea and fertilized eggs are rinsed with clean seawater. At the end of the night, we take a midnight swim to the CRIB where the larvae are released for settlement on the units.

The informal part of the training was just as memorable. We built connections across the region, sharing stories about the challenges and successes working in the field of coral reef conservation. We connected with Fragments of Hope, an NGO from Belize that mastered methods for coral propagation by fragmentation to restore the reefs that have been physically destroyed by hurricanes. We also met with the St Barth Coral Restoration and The Association Igrec Mer from Guadeloupe. Both invest time into beautifully designed artworks for their coral reef and ocean outreach tools. We had much to learn from each other.

Never keep your eggs in one basket!

Diversity of ideas, people, methods, and backgrounds is essential for developing innovative strategies to combat and mitigate the impacts of climate. For coral reefs, we have the best minds in the Caribbean and around the world focussed on the challenges of conserving corals that relies on integrated partnerships with engineers, aquaculturists, economists and ecologists from around the world. The IMA would like to thank SECORE International for the amazing opportunity, and for providing solutions to safeguarding our coral reefs.



inside the CRIB. Photo by Anjani Ganase

Construction of the Tobago Marine Field Station

Pigeon Point, Tobago

A NEW MARINE FIELD STATION AND INTERPRETIVE CENTRE FOR TOBAGO

THA GRANTS IMA LAND FOR CONSTRUCTION

Tobago will get its first Marine Field Station and Interpretive Centre at the Pigeon Point Heritage Park! This, as the Tobago House of Assembly (THA) has granted land to the Institute of Marine Affairs (IMA) to construct its field station to facilitate marine scientific research, public education and marine conservation activities on the island. Established in 1978, the Institute is the only marine scientific research organisation in Trinidad and Tobago.

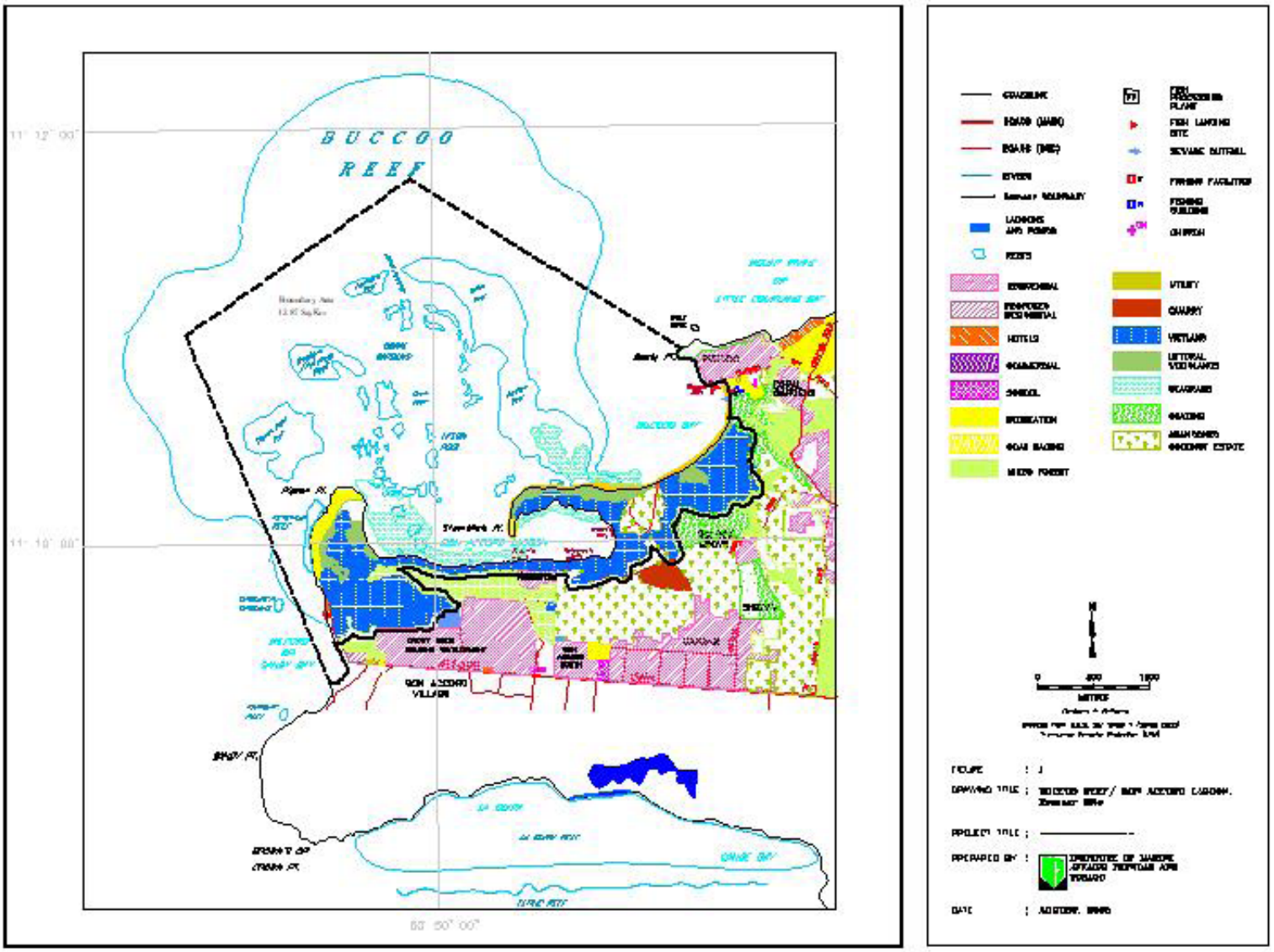
The facility will be located within the Pigeon Point Heritage Park to the western landward limit of the Buccoo Reef Marine Park, which is a Marine Protected Area. This area hosts an ecologically rich and complex wetland comprising coral reef, seagrass, and mangrove. The site is also a popular beach, water sport and recreational area, attracting an estimated 40,000 tourists annually. IMA's presence will serve to promote marine conservation and awareness initiatives which, it is believed, will redound to a more informed public, appreciative of the benefits of island's wetlands and marine areas.

The IMA will also undertake to lend its services to the Buccoo Reef Marine Park; monitoring the beach, coral reef, seagrass, mangrove and water quality to inform management actions and decisions of Park Management. The Institute will work alongside Park Management to design conservation programmes to promote unique eco-tourism products and experiences, such as lionfish culling exercises, reef surveys, and mangrove walks, to list but a few.

The facility will boast of a fully equipped:

- Wet Laboratory with a flow-through sea water system and aquaria to store live specimens and conduct ex-situ experiments, with counter space for dissections and the processing of biological samplings;
- Dry laboratory to house microscopes, water bath, computers, drying oven, balances, freezer, fridge and sediment samples;
- An Interpretive Centre with large marine aquaria, learning material both printed and digital and library; and a living classroom which would include a short boardwalk through the mangroves.

The facility will also provide accommodation for offices, conference and meeting spaces, storage for laboratory materials and chemicals including geology and oceanographic equipment, access to slip way, jetty, and area for mooring boats and garage for IMA vehicle and vessels. The new offices will not only facilitate IMA research but support training initiatives benefitting the island's students and young scientists. Visiting international researchers, working collaboratively with the IMA, will also be able to gain access to the facility. The project will also enhance existing cooperation and collaboration between the Divisions and Departments of the THA and the IMA



Site map

The Institute has already been instrumental in the provision of an Assessment of the Coral Reefs of Tobago, the Development of a Management Plan for Buccoo and Speyside Reefs, and an Economic Evaluation of Coral Reef Resources in Tobago. In addition to its ongoing monitoring exercises, the IMA hopes to further habitat mapping exercises at reef sites in Tobago, conduct reef connectivity studies and coral disease assessment. Mangrove, seagrass and coral restoration work, nitrogen loading modelling, isotopic studies, mariculture, fish age and growth assessment and vulnerability assessments are also planned.

The National Insurance Property Development Company Limited (NIPDEC) is the project manager and will issue a tender for the design, construction and outfitting the facility, in the months ahead.

Photo credit:Reef.org

The Development of a Lionfish Fishpot Fishery in Tobago, W.I.

In 2022, the IMA hopes to implement a Green Fund funded project entitled "The Development of a Lionfish Fishpot Fishery in Tobago". This project builds on the work done on the recently concluded project "Control and Management of the Invasive Lionfish (Pterois volitans) in Trinidad and Tobago", which focused on lionfish education and awareness from 2014 -2020.

In Trinidad and Tobago, lionfish population abundance and control continues to be limited to mechanical removal via culling in areas and depths accessible to free divers and scuba divers. These efforts have been occurring through recreational diving and intermittently during derbies and fishing tournaments. In general, deeper waters have been neglected and fishermen that deploy fishpots in these areas have reported the occurrence of lionfish in their pots as bycatch. Given the existing conditions and the interest shown by fishermen, restaurant owners, and general members of the public, the aim of this project is to control the invasive lionfish population in Tobago's waters by developing a lionfish fishpot fishery. This sustained exploitation is expected to deter possible negative impacts of this invasion to the marine ecosystem and to those that depend on it for their livelihoods. The development of this fishery may also reduce fishing pressure on native stocks traditionally exploited by the fishpot fishery and may offer improved livelihood options to some, including women.

Fishpots currently used by the fishermen will be modified in various ways in an attempt to increase the capture of lionfish. Modifications may include but are not limited to:

- Pot material (wire mesh versus plastic or wood)
- Bait (bait or no bait, small plastic fish, oily baitfish in bags, live versus dead bait)
- Funnel design (shape, location)
- Shaded or non-shaded

The interaction of lionfish with the fishpots will be captured using an underwater camera setup. This interaction will be used to fine tune modifications and do determine the best time for pot deployment etc.

Within their invasive range, studies have shown that not only are lionfish voracious eaters, consuming large quantities, but they are also generalists consuming a wide diversity of juvenile and small-bodied adult reef fish as well as small invertebrates. Although these

studies have not shown that lionfish prey on a large number of commercially important species, impact to fisheries can occur indirectly as they feed on prey normally consumed by recreational and commercial species, and heavy predation on native reef species may alter ecosystems. An analysis of stomach content (prey present) can provide some insight into possible ecological and economic impacts of this invasion in local waters. The gut contents of lionfish will be identified using DNA metabarcoding. This method has the advantage over traditional morphological identification in that it allows for the identification of both partially and completely digested contents. Studies using DNA metabarcoding have identified up to three times more species than that recorded by the more traditional morphological method.

Overall, the specific objectives of the project are to:

1. To characterize the fishpot fishery in Tobago.
2. To determine the status of lionfish populations around Trinidad and Tobago.
3. To design a lionfish fishpot for use in Tobago's waters.
4. To determine the possible impacts of the lionfish invasion on commercial fisheries through stomach content analysis.
5. To quantify the levels of polyaromatic hydrocarbons and heavy metals in lionfish caught locally.
6. To develop a Lionfish Management Response Plan for Trinidad and Tobago.

Non-containment lionfish traps being tested by the University of Florida offshore Destin, FL. Credits ALEX FOGG

Operationalization of the IMA as a Regional Activity Center (RAC) for the Land Based Sources of Pollution (LBS) Protocol of the Cartagena Convention

Darryl Banjoo PhD
Deputy Director - Research (Ag.)

The Institute of Marine Affairs is the oldest multi-disciplinary marine research organisation in the Caribbean Community (CARICOM) States established to conduct inter-disciplinary studies and is recognized as one of the two Regional Activity Centres (RACs) for the LBS Protocol under the Cartagena Convention.

The Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (WCR) or Cartagena Convention is a regional legal agreement for the protection of the Caribbean Sea. The Convention was adopted in Cartagena, Colombia on 24 March 1983 and was enforced on 11 October 1986. The Convention is supported by three technical agreements or Protocols on Oil Spills, Specially Protected Areas and Wildlife (SPAW) and Land Based Sources of Marine Pollution (LBS).

- The Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region was adopted in 1983 and entered into force on the 11 October 1986.
- The Protocol Concerning Specially Protected Areas and Wildlife (SPAW) in the Wider Caribbean Region was adopted on 18 January 1990 and enforced on 18 June 2000.
- The Protocol Concerning Pollution from Land-Based Sources and Activities was adopted on the 6 October 1999 and enforced on the 13 August 2010.

The Regional Coordinating Unit (UNEP-CAR/RCU) was established in 1986 in Kingston, Jamaica and is the Secretariat to the Cartagena Convention and its Protocols.

HISTORICAL BACKGROUND OF IMA AS A RAC

On the 4 April 2018, the Honourable Minister of Planning and Development, Mrs. Camille Robinson-Regis and Dr. Lorna Innis, Coordinator, UN Environment Cartagena Convention Secretariat, signed the official agreement to have the IMA recognized as a RAC of the Caribbean Environment Programme (CEP) of the United Nations Environmental Programme (UNEP). In accordance with Decision IX, of the Tenth Intergovernmental Meeting (IGM) of the Cartagena convention, 7-11 May 2002, two RACs were established to support the LBS Activities. These

Planning & Development Minister - the Hon. Camille Robinson-Regis signing the RAC agreement in April 2018. Looking on is Dr. Lorna Inniss, Coordinator, Cartagena Convention Secretariat, Ecosystems Division

were established within the existing institutions of the Centro de Ingeniería y Manejo Ambiental de Bahías y Costas (CIMAB) in Cuba and the IMA in Trinidad and Tobago. At the 7th conference of parties (COPs) in 2002, Parties agreed that IMA be the designated RAC for the English speaking islands of the Caribbean, undertaking activities aimed at implementing the LBS Protocol at the regional level. Since then the IMA in principle, has been delivering on its mandate as the LBS RAC, in a number of ways.

These activities are detailed in the biennial RAC reports to the Convention in support of the broad headings of the UNEP-CAR/RCU Work Plan:

Support to Programme Coordination and Management:

- Hosted of Workshop and Training.
- Supported activities that promote the ratification and implementation of the LBS Protocol
- Production of promotional videos on the LBS protocol.
- Hosted Regional Workshop for the Launch of the Caribbean Platform for the Global Partnership on Nutrient Management

Land and Marine Based Sources of Pollution Management:

- Participation in Workshops and Training
- Conducted Monitoring and Assessment Projects. Submission of environmental data.
- Supported the Regional Nutrient Pollution Reduction Strategy and Action Plan
- Supported the State of Convention Area Report (SOCAR) development.
- Supported the Scientific, Technical and Advisory Committee (STAC).
- Supported the Monitoring and Assessment working group and data sub-group.

Knowledge Management and Communications:

- Production of a public education and awareness video on the work of the CEP.
- Production of article on CEP website on Ecosystem based management.
- Design and development of GIS maps, infographics as well as promotional and awareness
- material about the LBS Protocol

OBJECTIVES OF RAC- IMA

The RAC-IMA will seek over the 2021-2026 period to provide the overall supervision, technical guidance and administrative oversight for the implementation of specific and selected activities to fulfil the LBS Protocol and its Convention assigned by the Contracting Parties for the RAC through UNEP-CAR/RCU. The primary objective is to provide scientific and technical support to the UNEP-CAR/RCU for the coordination of the implementation of the Cartagena Convention, its Protocols and on the following:

a. To assist the UNEP-CAR/RCU with the development and the identification of potential sources of funding to ensure the achievement of Convention/Protocol.

b. To facilitate the provision of technical and scientific assistance (expertise, consultancies) to Contracting Parties and other governments, as appropriate;

c. To promote the implementation of specific activities individually or jointly in cooperation with e.g. UN specialised agencies, intergovernmental, governmental and non-governmental organisations;

d. To foster scientific and technical cooperation with UN specialised agencies, intergovernmental, governmental and non-governmental organisations, for example;

e. To promote cooperation on research and monitoring and assessment needs of the region.

Strategic Directives of RAC IMA

The strategic directives for the development of the 2021-2026 Strategic Plan would be based on support to UNEP-CAR/RCU as a RAC and alignment to the draft updated Caribbean Environment Plan (CEP) Strategy. RAC-IMA activities will be closely aligned to the achievement of the CEP Strategic objectives as summarised below:

- **Strategic objective 1**: Enhance regional and national decision-making and policy-making for improving the management of coastal and marine resources of the Wider Caribbean Region – Knowledge Management and Communications;

- **Strategic objective 2**: Increase use of innovative pollution prevention and reduction tools, innovative/appropriate technologies including circular economy approaches, waste as a resource and sustainable consumption and production - Pollution Prevention, Reduction and Control;

- **Strategic objective 3**: Support policies, strategies and action plans that enable the integrated management and sustainable use of coastal and marine resources; - Marine Biodiversity Conservation and Management; and

- **Strategic objective 4**: Implement innovative institutional, policy, legislative and financing programmes, projects, instruments and initiatives to facilitate a transition to sustainable ocean-based economies. – Ocean-Based Economies.

The sixyear long term strategic plan being developed by RAC- IMA is aligned with IMA's Cabinet approved 2019-2024 strategic plan. As part of the major organisational strategic objectives, it is expected that 60% of the Institute's obligations to the RAC activities would be done on a phased basis over a two-year period. The development of RAC organisational structure and filling of vacancies would be a priority in the present biennium. Economic constraints in recent times and the impact COVID-19 pandemic has meant that RAC-IMA is required to seek grant funding to account for a decline in government subventions. As part of the major financial objectives, it is expected that grant funding will represent at least 60% of its research budget (10% in the first two years, 20% by the third year and 40% by the end of the six-year strategic period). Operational cost reduction by 15% through a value for money approach and optimising available resources will also be critical.

The list of projects and activities in which RAC – IMA can contribute includes project coordination and implementation, hosting of training workshops in oil spills monitoring and assessments, nutrients, sampling, capacity building on environment monitoring and assessment. RAC IMA will continue to contribute to in-kind to small scaled funded projects with UNEP CAR/UNEP and will seek grant funding from other sources.

The Carbon Rainbow

Attish Kanhai,
Benthic Ecologist, IMA

"... Someday I'll wish upon a star
And wake up where the clouds are far behind me
Where troubles melt like lemon drops
Away above the chimney tops,
that's where you'll find me.

Somewhere over the rainbow, blue birds fly
Birds fly over the rainbow,
why then, oh why can't I?"

... sings Dorothy in the iconic scene from the 1939 film Wizard of Oz as she contemplates the words of her Aunt Em who tells her to find a place where she can't get into any trouble. Somewhere over the rainbow seemed like the ultimate escape, a place of freedom, where the shackles of reality melted away. For as long as rainbows have existed they have held deep symbolism for many different cultures. In Greek and Norse mythology, a rainbow connected two worlds and was a path that connected to the Gods. In Greek mythology, Iris, the goddess of the rainbow used it as her own personal highway to convey celestial messages. In Norse mythology, which might be more popular now thanks to the Thor movie franchise, the rainbow bridge or Bifrost is the coloured arc that connects the earth realm to the realm of the Nordic Gods and their place of abode in Asgard.

Apart from Norse mythology other cultures believe a rainbow symbolizes a link between life and death as one transcends the earthly realm into the afterlife. The Buddhists believe your body transcends to a form known as the rainbow body or "body of light" which is a sign of your ascension towards God. And of course the most common symbolism of the rainbow is the Christian belief of the promise made by God to Noah after the Earth was flooded to rid it of sin and evil. The rainbow signified that God would not destroy the Earth via floods and the promise of a better future.

I will leave any further discussions about leprechauns and pots of gold at the ends of rainbows for another time. But I will say to date, no one has reported such findings to the relevant tax authorities, as far as any of us are aware.

Given the historic significance of rainbows, the future of the Earth is also in the hands of another important scheme of colours that bears understanding. Blue, green, red, grey, brown, black and teal are all different colours assigned to sources and sinks of carbon regarding where it originates or ends up.

Blue carbon is one of the more popular colours of carbon and refers to carbon stored and captured by the world's oceans and coastal ecosystems. The most common of these ecosystems are seagrass beds and mangrove forests. In addition to the leaves of these plants capturing carbon from the atmosphere while they are living (organic or above ground carbon) they are also capable of storing carbon in the soil beneath their roots which makes up the vast majority of their carbon storing capabilities. Mangroves and seagrasses sequester carbon at rates higher than terrestrial forests but are some of the most threatened ecosystems worldwide. Conservation and replanting efforts of these environmentally sensitive species are essential to the Earth's carbon cycle as the burning of fossil fuels continues to release carbon into the atmosphere. This brings us to three other colours of carbon: grey, brown and black.

Grey carbon refers to carbon stores in fossil fuels such as coal before it is used. Upon ignition, incomplete combustion of fossil fuels, the soot, or black smoke

produced is what is known as ***Black*** carbon. Ideally, grey carbon should remain grey carbon, locked away in its original form, but the need for energy makes the non-use of fossil fuels at this present time all but impossible. Alternative sources of fuel continue to be developed that, in the future, will reduce or even completely replace grey carbon sources.

Relative to their treatment, forests are home to two different carbon colours. ***Green*** carbon, as the name suggests, refers to carbon stores in the living or organic material of trees once left untouched. In a broad sense, forest reserves or those not subjected to any kind of industrial activity can be sinks for sequestered carbon. Once forests become industrialised or commercialised, the carbon released from timber or commercial species upon their use as a source of raw material for industrial manufacturing or commercially for wood, they become known as ***Brown*** carbon.

The final two colours are probably less well known. ***Red*** carbon refers to carbon stored and captured by all living organisms on snow and ice. Yes, I know, why red? Shouldn't snow carbon be white? "Red expresses a common pigment produced by snow microorganisms, but the term also encompasses pigments spanning yellow through to purple. These colours absorb abundant green and blue wavelengths of light, melting the snow and ice, and "producing liquid water necessary for life, and freeing up nutrients (such as nitrogen and phosphorous) that are bound within ice crystals" according to Roman Dial, Professor at Alaska Pacific University1

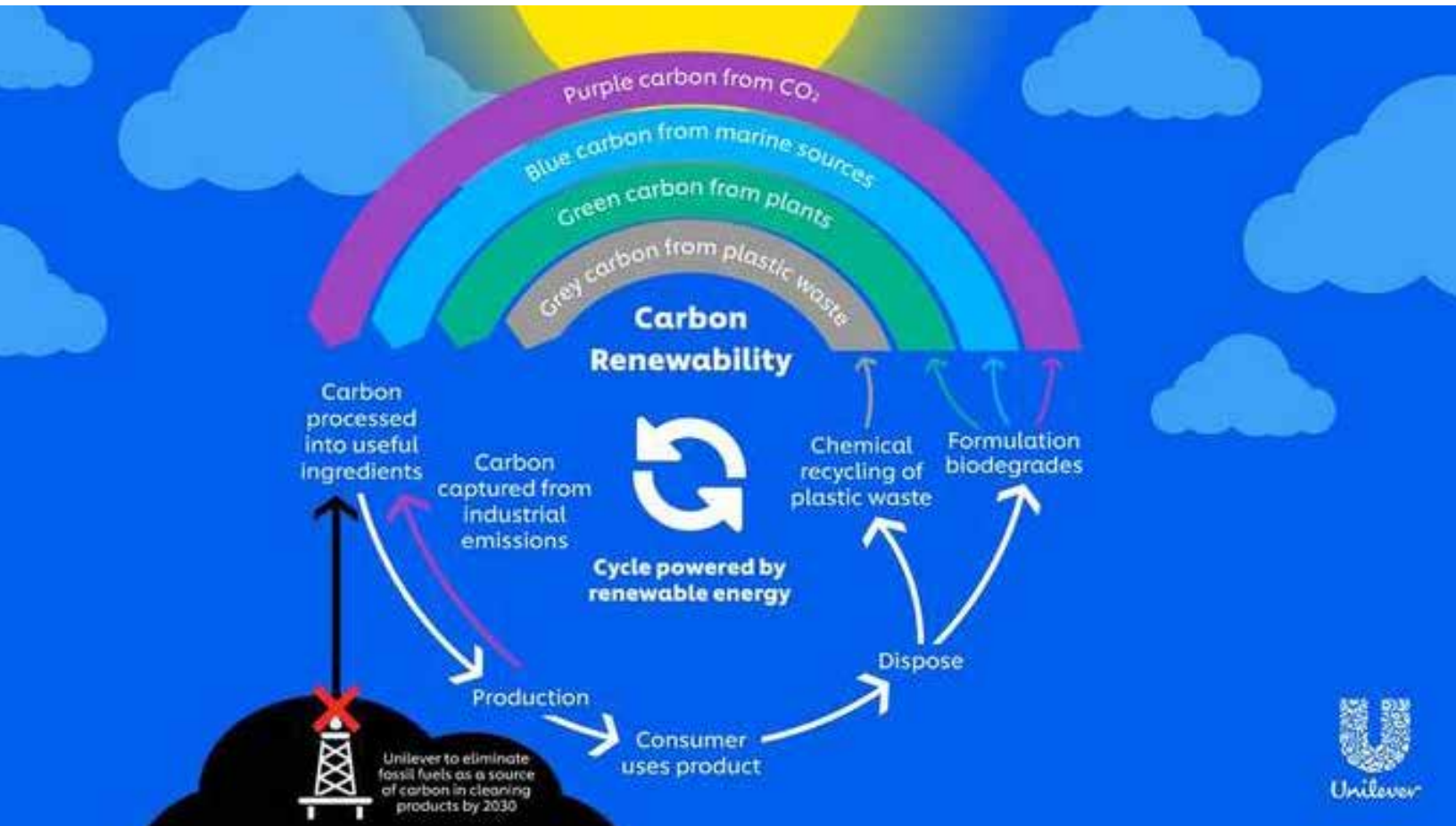
The most recent addition to the carbon rainbow is ***Teal*** carbon. Long before it was a popular colour for weddings, teal carbon was being stored by inland freshwater wetlands such as shrubs, sedges and herbs. Similar to blue carbon, but not quite, I assume that is how teal carbon emerged as a distinction from blue carbon.

To date these are the colours encompassing the carbon rainbow. More may yet be added in the coming years as further investigations into the carbon cycle continue. The understanding of the processes by which carbon is cycled through its various forms continues in an attempt to keep the blue birds flying and rainbows shining for as long as possible on planet Earth.

References:

1. Dial, R. J. et al. FEMS Microbiol. Ecol. 94, fiy007; 2018

'Over the Rainbow'
1939 by Leo Feist, Inc.
lyrics: E.Y. Harburg



This issue marks the beginning of a very special season in our calendar. It's Christmas! As we celebrate this holy birth, may the peace of God the Almighty keep your hearts and minds; may His presence fill your homes with joy and gladness; and may you prosper and be in good health as the new year, 2022 dawns.

"For unto us a child is born, and unto us a son is given. And the government shall be upon His shoulders. And His name shall be called Wonderful, Counsellor, the mighty God, the everlasting Father, the Prince of Peace" Isaiah 9:6-7.

Merry Christmas and Happy New Year, from the Management and Staff of the Institute of Marine Affairs!

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THE BLUE CORNER

Oysters

When one thinks of oysters, normally the first image to come to mind are the sidewalk carts regaled with the classical flambeau, a mountain of rough shells and a bottle of bright red pepper sauce, perhaps around the Queen's Park Savannah. Indeed oysters are the food of weekend legends. It is a popular delicacy for many looking for something new and for those who are convinced of the oyster's aphrodisiac effects.

However, did you know besides moonlighting as food oysters are natural filter feeders? This means they feed by pumping water through their gills, trapping particles of food as well as nutrients, suspended sediments and chemical contaminants. In doing so, oysters help keep the water clean and clear for underwater grasses and other aquatic life. Oyster is the common name for a number of different families of salt-water bivalve molluscs that live in marine or brackish habitats. In some species, the valves are highly calcified, and many are somewhat irregular in shape.

https://www.thenewhumanitarian.org/feature/2017/12/18/jury-still-out-huge-mangrove-regeneration-project-senegal

IMA NEWS

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