Volume 5

# EXPLORE

*The 2020-21 collection of Global Underwater Explorers featured diving projects*

**NEW ZEALAND**

Building a Biodiversity Baseline

**CYPRUS**

Cleaning the sea around the Cypriot Island

**INDONESIA**

The Revival of Bali's Degrading Reefs

**UNITED KINGDOM**

A Year of Citizen Science

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20+ PROJECTS IN 14 DIFFERENT COUNTRIES

GLOBAL Underwater Explorers

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COVER PHOTO **GRAHAM BLACKMORE**

# LETTER FROM THE PRESIDENT

*It would be difficult to fully capture the surreal life and difficult challenges experienced by so much of the planet over the last two years. Many of us were impacted to varying degrees and with differing effects but few, if any, were unaffected by the Covid pandemic.*

*Despite the challenges, many people adapted and a lot of intrepid souls managed to amplify their activities in pursuit of the sport they love. Having four of my own expeditions canceled, I look with respect upon all those that were able to fulfill their personal goals while extending the global ambitions of our organization.*

*Please join me in celebrating the passion, ingenuity, and successes of our many GUE 2021 project teams as they unfold across the following pages.*

*With gratitude and respect,*

*Jarrod Jablonski*

# BUILDING A BIODIVERSITY BASELINE

## AOTEAROA LAKES

*By Ebrahim (Ebi) Hussain*

### CURRENT STATE

NEW Zealand has approximately 775 lakes, but only 127 of them are regularly monitored. Most of these lakes are monitored only for water quality trends, and almost none of them have any detailed assessment of in-lake biodiversity and ecology.

Water quality parameters reveal a lot about a water body, but they are only one piece of a very complex puzzle. Without an ecological context, water quality trends can be misleading, as it describes only a subset of ecosystem functions; physicochemical parameters alone are not a suitable proxy for lake ecosystem health.

Lake ecosystems, and the biodiversity they support, are some of the most threatened environments globally. The lack of baseline-state data is largely attributed to the complexity and effort involved in obtaining comparable in-lake ecological assessments.

### ACTIONS

Aotearoa Lakes is an environmental charity, driven by citizen science, working on a variety of lake projects across New Zealand. One of the overarching goals included in every project is the establishment of an in-lake biodiversity and ecological health assessment for each site. In addition to project-specific objectives, we collect a set of standardized observations and measurements from every lake we work in. We are using this information to build a national database of lake ecosystem health and in-lake biodiversity.

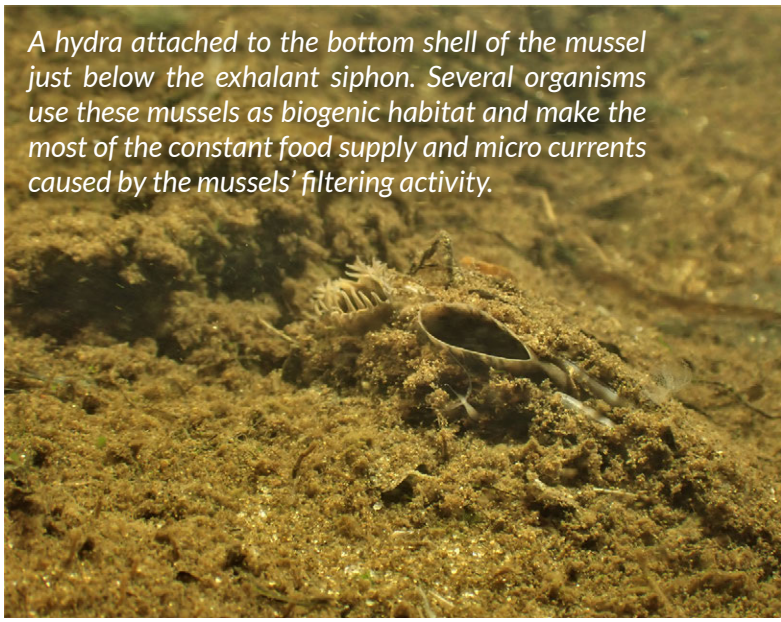
We have used a variety of techniques—including traditional techniques, eDNA, light stations, and various survey methods—to assess biodiversity values, biosecurity risks, potential impacts, stressors, littoral health, and general ecological functions.

This project submission will discuss some of the biodiversity and ecology highlights from the last year of surveys.

### FRESHWATER MUSSELS (KĀKAHI)

We have been surveying freshwater mussels (kā kahi) for several years now and have almost completed a comprehensive regional distribution of these threatened species across Auckland lakes. Over the past year, we have expanded our surveys to a new region (Hawke's Bay) and have conducted more in-depth investigations around the key drivers behind the population collapses we are seeing in all Auckland lakes.

We have been studying each part of the mussel life cycle in several lakes to identify where the failure in recruitment stems from. In Lake Tomarata,



*A hydra attached to the bottom shell of the mussel just below the exhalant siphon. Several organisms use these mussels as biogenic habitat and make the most of the constant food supply and micro currents caused by the mussels' filtering activity.*

*A dense wall of Hornwort (*Ceratophyllum demersum*) towering over a low growing native charophyte bed. Hornwort grows rapidly and pushes native species into deeper water where they can no longer survive. They alter the littoral zone so that charophytes can no longer establish.*

*Dense epiphytic algal growth covering tall Hornwort stems. Epiphyton is commonly associated with eutrophic environments and prefers to establish on plants with complex structures.*

we found the biomass of intermediate hosts is sufficient to support a large population of mussels, and there is still appropriate adult habitat availability. We have been looking at the attachment rate of the parasitic glochidia to the intermediate fish host and have confirmed a high degree of encystment. These studies indicate that spawning and attachment to intermediate hosts is occurring successfully. Over the next year we will be focusing on juvenile survival and the development stages once they have detached from the intermediate hosts.

We know mussels are ecosystem engineers and have a critical role in nutrient cycling and bioturbation, but we now find that they also serve as biogenic habitat for other organisms. This observation showed us how little we know about the ecosystem functions these key stone species provide.

## LIGHT STATIONS IN LAKE ROTOTOA

We have been using eDNA and traditional traps to get an overview of what fish species occupy Lake Rototoa and what the current state of their populations is. Like most Auckland lakes, Lake Rototoa is dominated by invasive species (perch, tench, and gambusia), and their biomass is so large that they have almost entirely displaced all native fish species.

Traditional fish surveys did not provide much information on the biomass of juvenile fish (native and exotic), which is a critical knowledge gap when trying to draft a management strategy. We experimented with using passive light stations to draw out juvenile fish and get estimated counts. The light stations worked amazingly well, and within minutes we started seeing juvenile fish.

Surprisingly, we began to see dwarf inanga (*Galaxias gracilis*), a native fish that was thought to have gone extinct in this lake. It was truly astonishing to see this unexpected species congregating around the light stations. Kōura (native freshwater crayfish) were also drawn to the light stations. These species were once abundant in this lake but are rarely seen now. The passive light stations proved to be a great way to detect cryptic species that occur in low numbers.

The light stations were also a useful way of assessing the macroinvertebrate populations. Macroinvertebrates are a food source for many species but also provide valuable ecosystem functions like processing organic matter. Currently there is no effective method for surveying macroinvertebrates in deep margined lakes with dense emergent vegetation; however, passive light stations coupled with eDNA show great potential and

*These native mites were drawn to the static light stations, and we have never seen them in these numbers before. The light stations are incredibly useful when surveying macroinvertebrates.*

have given us a much better understanding of the macroinvertebrate diversity and biomass in Lake Rototoa.

## MACROPHYTES

Over the past year, we have done a lot of work on macrophytes across Auckland and Hawke's Bay. One of the highlights for the team was the discovery of native macrophytes in Lake Tomarata, as this lake had been considered devoid of vegetation since 2012. We found several native species (*Chara australis* and *Nitella leonhardi*) still growing in pockets around the lake, and we were amazed to see healthy growth and evidence that the macrophyte cover is increasing, despite a decline in water quality.

We have been focusing on assessing the impacts of invasive macrophyte species across several lakes, in particular Hornwort (*Ceratophyllum demersum*), Oxygen weed (*Egeria densa*), and Canadian pond weed (*Elodea canadensis*). These invasive species are causing significant damage and are altering the ecosystem functions across all the lakes we focused on over the past year.

During a baseline assessment dive in Lake Kowhai, we mapped out extensive native macrophyte beds dominated by *Chara australis*, *Nitella leonhardii*, and *Potamogeton ochreatus*. Despite this being one of the most intact native macrophyte assemblages we have seen in the region, we discovered isolated stands of invasive *Egeria densa*. We planned to start the removal of this invasive macrophyte mid last year but had to postpone the dives due to COVID-19 restrictions. We will begin removing the *Egeria* in June 2022, with two follow-up removals every year for three years. If we can successfully remove all the *Egeria* from this lake, it will be the only lake in the Auckland region that has no significant invasive macrophyte biomass. The *Egeria* removal and riparian restoration will help preserve one of the best examples of native charophyte meadows left in the region.

We completed a Hornwort (*Ceratophyllum demersum*) delimitation and impact assessments in Lake Rototoa (Auckland) and Lake Rotoroa (Hawke's Bay). Lake Rototoa has a relatively small biomass of Hornwort compared to its size, and the beds occur in discrete locations within the littoral

zone. Control is already underway and will limit the extent from increasing. Lake Rotoroa, on the other hand, has a high biomass of Hornwort and *Elodea* that dominate a majority of the littoral zone. These invasive macrophytes are the single biggest impact to this lake. We have completed the initial surveys and are working toward a control strategy this year.

## WHAT HAVE WE LEARNED?

We have collected a huge amount of data from several lakes, and we are seeing some concerning trends. In general, we are seeing a displacement of native biodiversity by invasive species, loss of key stone species, increased eutrophication, and a collapse of littoral ecosystem function.

We have documented the loss of ecosystem functions, which have major implications for long term lake health, across all our project lakes. We know that external (catchment related) and internal (legacy nutrients) nutrient loading is a key driver, but the impacts of invasive species are having an equally profound effect. Invasive macrophytes alter habitats by creating unfavorable microclimates with elevated temperatures, low dissolved oxygen, limited light penetration, and increased sedimentation (organic and mineral). These conditions displace native species which provide critical ecosystem functions. Invasive fish alter the trophic structure of lakes and have led to the extinction of many native species from several lakes. This predation pressure contributes to the shift from a clear water state to a turbid algal dominant state.

These pressures create a low biodiversity, high nutrient state system that is extremely difficult to restore. Our observations paint a dire picture for our lakes and prove that water quality monitoring alone is not enough to ensure sustainable lake health management. Over the next year, we will continue to build our baseline data sets and emphasize the importance in maintaining littoral zone health and native biodiversity.

## DIVE TEAM

*Ebrahim (Ebi) Hussain, Louise Greenshields, Russell Hughes, Mark Long*

*Mucus enclosing the fruiting bodies (female oogonia and male antheridia) of* Nitella leonhardii. *This was a great sign that new native growth is occurring in Lake Tomarata.*

*Louise Greenshields mapping stands of invasive* Egeria densa *in preparation for future removal. The removal of this fast-growing pest plant is critical in preserving the native biodiversity value of Lake Kowhai. Mapping these areas is also necessary for long term monitoring and will be used to assess native regeneration from seed banks.*

USA

# CRACKS CAVE EXPLORATION & SURVEY

## FLORIDA

*By Meredith Tanguay*

**LOCATED** adjacent to the Withlacoochee River in northern Florida, Cracks is currently averaging 48 m/160 ft deep with significant flow. This cave system is not open to the public; Karst Underwater Research (KUR) is exploring this system and has begun detailed survey and cartography of it, under permits issued by the Florida Forest Service and Suwannee River Water Management District. In 2021, weather windows permitted three dives. This project is ongoing with additional dives planned in 2022.

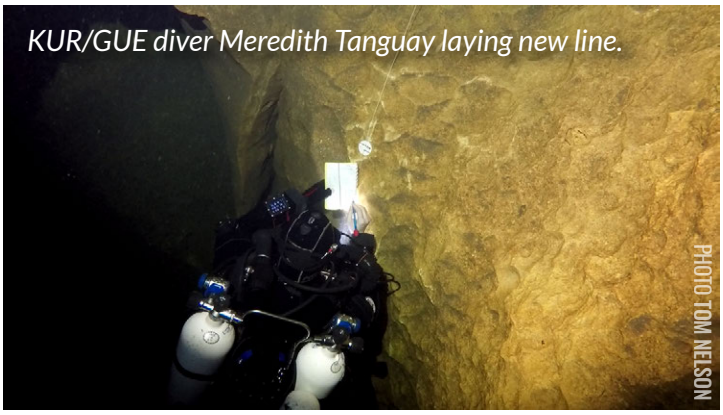

KUR/GUE diver Meredith Tanguay laying new line.

PHOTO TOM NELSON

### DIVE TEAM

*Adam Hughes and GUE Diver Meredith Tanguay are spearheading exploration and survey efforts at this site. Other divers include Tom Nelson, Matt Hansen, and Chris Brock.*

### SPONSORS

*Karst Underwater Research is a 501(c)(3) nonprofit organization and is sponsored by: Divesoft, Fathom Dive Systems, Dive Rite, Golem Gear, Dive Long Intersorb, ScubaForce USA, Stay Dri Scuba, Diver City, and Aqua Vertical.*

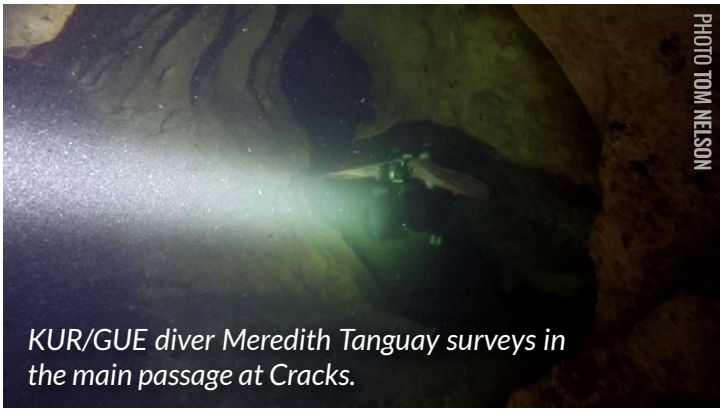

KUR/GUE diver Meredith Tanguay surveys in the main passage at Cracks.

PHOTO TOM NELSON

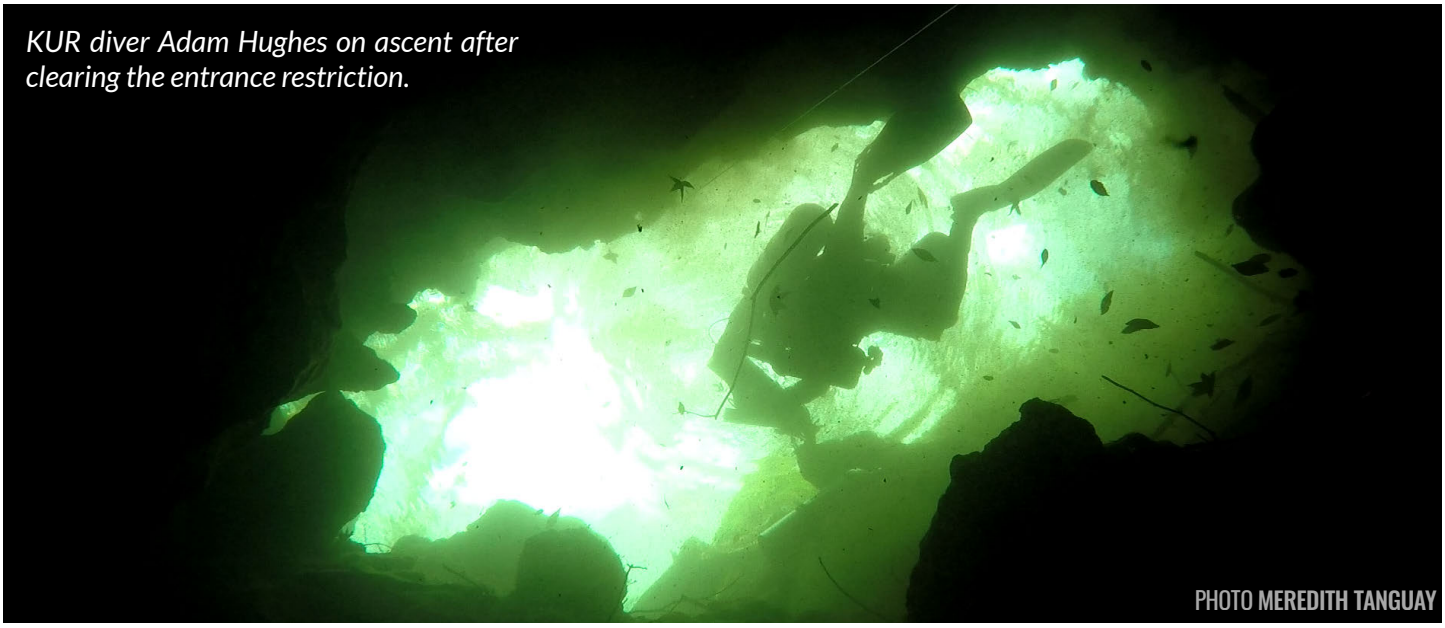

KUR diver Adam Hughes on ascent after clearing the entrance restriction.

PHOTO MEREDITH TANGUAY

# CLEANING THE SEA AROUND THE CYPRIOT ISLAND

## GHOST DIVING EAST MED

*By Imad Farhat*


*Approaching a net in the middle of the water is never recommended or advised, but with lots of experience, Ghost Diving divers know how to interact with nets while exercising minimum risk. Pictured are divers are getting up close and personal to inspect and free entangled creatures from the net.*

**WHEREVER** there are people and the sea, a fishing community will be found that thrives on the use of fishing techniques, some of which will be conservative in nature, or even a bit environmentally friendly, but unfortunately most are the total opposite.

Yet again, it was the time for conscientious people to try to take collaborative action in order to achieve a better outcome.

Fishermen often report about ghost fishing nets having been either lost at sea or left behind due to technical problems while retrieving them.

The abundant marine life around the protected park area of Cape Greko in the eastern peninsula of the island attracts lots of boat fishing activities, resulting in what we fear and mostly encounter on our dives.

Leads coming in from different entities on the island, such as divers and fishermen, pointed us in the direction of a big net that was lost for some years but was still causing potential entanglement hazards to mammals and marine life alike.

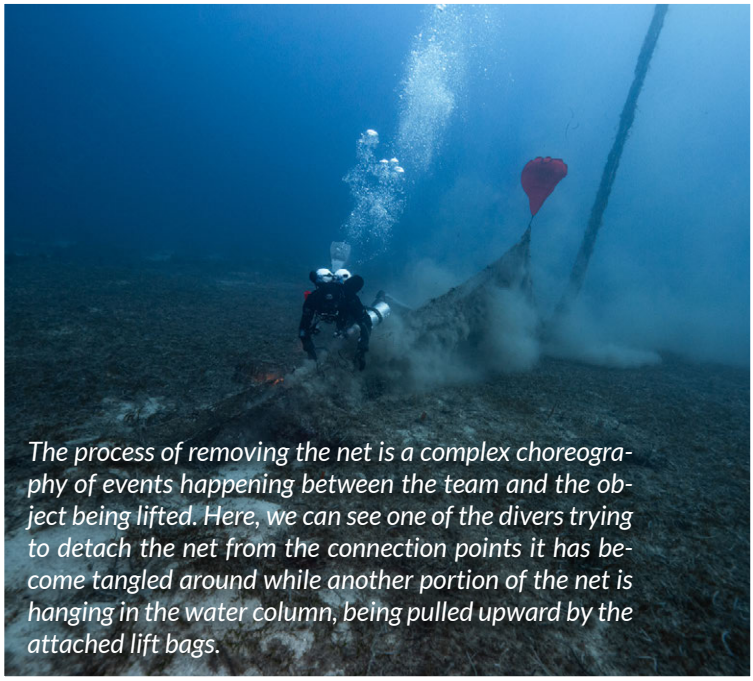
The divers from Ghost Diving and Ghost Diving East Med went in and scouted the net to acquire essential parameters for the project's success—aspects that were important to the planning phase such as location, depth, net status, and possible lifting scenarios—each representing an answer to questions that accommodate for safety, minimizing operational risks, and maximizing the project's efficiency.

The correct gases were blended, team strategies were formed, dive plans were created, and there was nothing else except to jump in and execute the project.

Working at depth is not an easy task, but GUE standard gases help greatly by minimizing narcotic values in order to provide better and safer


PHOTO IMAD FARHAT

*A part of the net being lifted to the surface using high capacity lift bags. The instant reduction of visibility that could be caused by the silt produced from nets moving in the water column can be clearly seen.*



*The process of removing the net is a complex choreography of events happening between the team and the object being lifted. Here, we can see one of the divers trying to detach the net from the connection points it has become tangled around while another portion of the net is hanging in the water column, being pulled upward by the attached lift bags.*

margins for similar diving chores.

Luck is not something that we always get on such projects, but on that day, sea conditions were thankfully optimal, visibility was great, and the team managed to locate and lift the net back to the surface. More than 200 meters worth of gillnet, or monofilament net, was retrieved, and you can see the size of the net in the pictures where the divers are decompressing next to it.

Once lifted to the boat, first things first, the net is searched for survivors, and if found, they are unentangled and reintroduced to the water—animals such as fish, crustaceans, sea stars, and an ample amount of other organisms can be possible victims to such ghost nets.

Once back to shore, the net is transported to a drying location, where it will be cleaned and stowed to later be shipped to a recycling facility in Europe. The lead parts of it will also be removed for future melting and upcycling into V-weights to be used by divers.

With the above initiative started in 2021, many future collaborative efforts are planned for 2022 between Ghost Diving, Healthy Seas, Ghost Diving East Med, and GUE Cyprus, ranging from community establishment, training, and classes, to project execution. We are hopeful that 2022 will be a bright year on the Cypriot shores.

## DIVE TEAM:

*Imad Farhat, Pascal van Erp, Julio Halal*

## SPONSORS:

*Ghost Diving, Healthy Seas, Ghost Diving East Med*

*Surface support is critical. In this case, the skipper is getting his hands dirty by helping the divers who are getting the recovered net onto the boat after the dive. Different methods of net recovery are possible, depending on several factors, such as weight, net material, and design.*

*After shooting the complete net to the surface of the water, you can see the divers in position, decompressing in the blue while inspecting for possible creatures to set free. A mini survey is being performed to pass the time during the decompression obligation.*

PHOTO IMAD FARHAT

# PROJECT DENÉE: CARRIÈRE DE 'LA BOSSE'

## GUE-BELGIUM

PHOTO IMAD FARHAT

*GUE-BE diver at the big wheel*

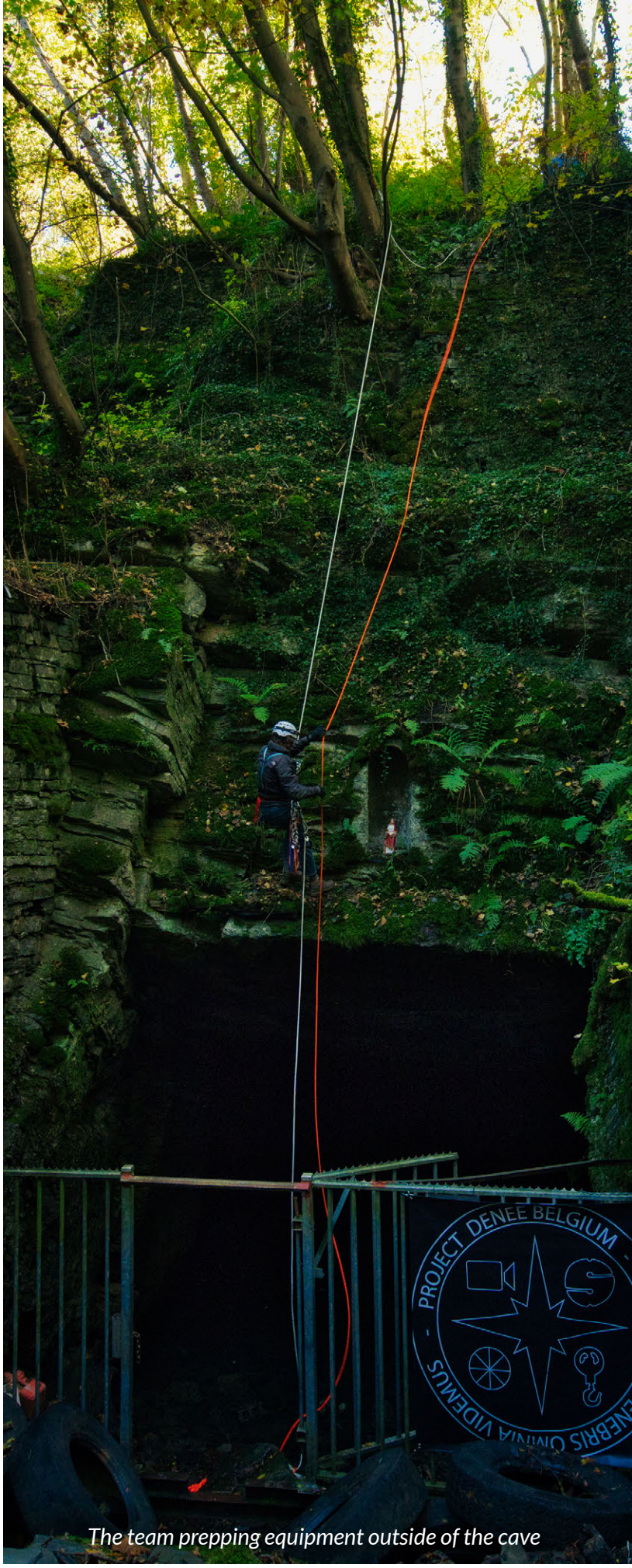
*By GUE Belgium*

## INTRODUCTION

**ASK** the average Belgian cave diver if they know the flooded mine of Denée—managed by the UBS—and they will confirm that they do without hesitation. Most will be aware that it is a black marble mine. And, while it's true that there is an old dive plan circulating on the internet, if you were to show a non-caver an underwater photo of the mine and tell them you planned to dive it, they would think you were crazy. Divers from Global Underwater Explorers Belgium (GUE-BE) and the Groupe Spéléo de Charleroi (GSC) are currently setting up a joint project to better document the mine and make this piece of Walloon industrial history accessible to the general public.

## THE IDEA AND FORMATION OF A TEAM: IN TENEBRIS OMNIA VIDEMUS

The idea for an underground project was born in 2020 at the GUE-BE (gue-be.be) board meeting. After several successful projects in the Belgian North Sea, in which divers documented the wrecks of the SS *Kilmore* and the *Westhinder*, members were asked if they wanted to organize a Belgian underground project. The club's cave divers provided a resounding "Yes," and began to organize the task, starting with the project objectives and the ideal team members. The team's aim was to document the La Bosse flooded mine in Denée, to check whether the old map was correct, to make a documentary film about it, and to create a website for the general public containing all the research, photos, interviews, films, and 3D material collected during the project. The team consisted of 16 members, each with their own specialization and interests. Blas Gallego Irles was the project leader and the coordinator for all the moving pieces. Olf Smetsers was in charge of the catering, Erik De Groef the video, Laurent Miroult the photography, Stéphane Riga the local relations and historical information, Johan Wouters the 3D, and Ramon Camp the website. At that time, COVID-19 measures limited the team to 10 active project divers. Because some of the GUE-BE members were already members of the GSC, we chose



*The team prepping equipment outside of the cave*

PHOTO GUE BE

*3D composition with photo*

this club to join with the other divers. Once registered, the new members would then have to complete a guided dive to show mastery of their skills and to understand the rules of the UBS. Wearing a helmet, for example, was new and was easily accepted. To promote and encourage team spirit, a polo and a hoodie were made with the logo of the project: Project Denée 2020 - in tenebris omnia videmus, translated to mean either “In the dark, we see everything,” or, in free translation, “We reveal what is unknown.” The logo designer provided free reusable mouth masks with the appropriate logo for each specialty.

Blas, our project leader, made sure that the dates of the project dives fit everyone, that snacks and drinks were available, that someone would provide a first aid kit with oxygen (both a large one above and a small one at the bottom next to the water), that someone who didn’t dive would be downstairs to help with the equipment, that the objectives for each team were clear, and that the

PHOTO LAURENT MIROULT

*GUE diver at pully*


teams respected the order of entry into the water. For example, the 3D team always had to enter the water first, as they preferred to have water as clear as possible. It was also agreed in advance which teams would stay in which parts of the mine, both to avoid unwanted encounters and to schedule desired meetings for making of shots. For another example, it was agreed that, at a certain moment, the film team would meet the 3D team in the central room, where the 3D team would make a turn in front of the camera while the camera rotated (around the axis) making a helicopter turn. Planning for these maneuvers was prepared down to the smallest detail and repeated during the briefing. And, although we were only able to do our first project dive on September 6, 2020, the good preparation ensured that we already had good preliminary results later that year. During the annual conference Tec 'n Wreck Night in the Netherlands, which always attracts international interest as well as the participation of divers from all over the world, our project leader was allowed to present the provisional results by introducing the film that the video team had put together by then.

The dive in La Bosse was a massive GUE-Belgium project that produced a lot of fun and enjoyable companionship!


*A GUE diver at the marble wall*

# RENA BOTTEN AND OPERATION SPÖKNÄT

## GUE SWEDEN

*By Per Normark, Helene Hagerman*
*All photos GUE Sweden unless otherwise noted.*

**GUE** Sweden was set up in 2019 to support and manage projects that address environmental protection and exploration in Sweden. GUE Sweden currently runs two projects: Rena Botten and Operation Spöknät.

Project "Rena Botten" (Clean the Seabed) has so far resulted in over 100 tons of debris being removed from the sea

Along the coast of Sweden, many piers have been used as dumping sites for many years. Glass, steel, and ceramics mixed with hazardous waste such as plastics, car tires, electronics, and batteries are present in many places along our coast.

Rena Botten started four years ago with the goal of removing waste from the seabed. And, at the same time, to encourage people to stop treating these fragile ecosystems as a waste dump. All divers and non-divers are welcome to join the project activities. Rena Botten is conducting between ten and 15 clean-up dives per year in different locations.

The cleaning activities are always carried out in collaboration with municipalities or other landowners who dispose of the waste once our divers have brought it to the surface.

Some of our "findings" from 2021 ended up at an exhibition at the new Wreck Museum "Vrak" at Djurgården in Stockholm, a museum about the world-unique cultural heritage that exists at the bottom of the Baltic Sea.

### OPERATION SPÖKNÄT

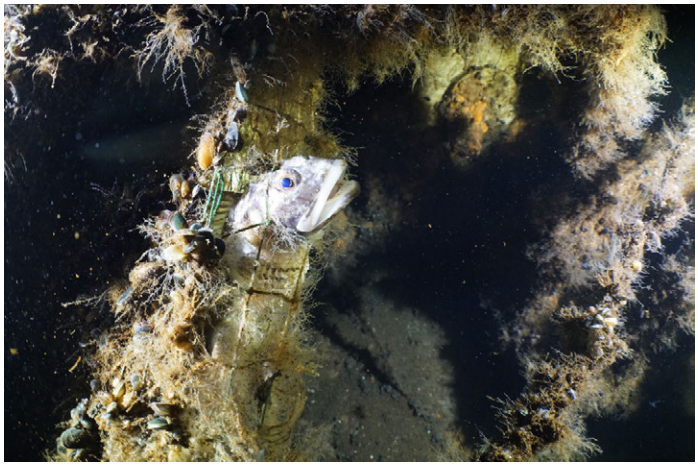
Operation Spöknät (Operation Ghost Net) was launched with the goal of improving the environment in the sea by locating, documenting, and recovering ghost nets.

*Most of the waste picked up by Rena Botten is car tires.*

PHOTO MAGNUS LUNDBORG

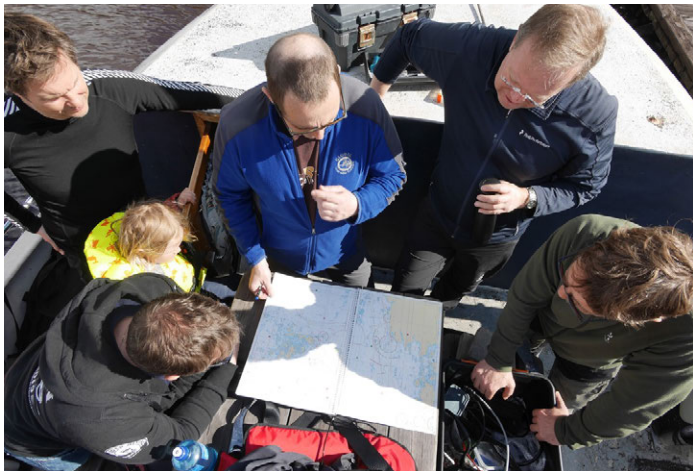
In 2020, GUE Sweden was granted funds to conduct two pilot studies on behalf of the County Administrative Boards in Södermanland and Kalmar counties. The overall purpose was to map and document ghost nets in order to enable retrieval of them. Based on recommendations by the EU project MARELITT and studies made by WWF in Germany, a search method using sidescan sonar was chosen to locate ghost nets. Once the sonar indicates potential findings, divers confirm and document these findings or dismiss them. Sonar searches require patience. With an effective search time of about five hours per day at sea, an area of about 2 km can be covered. The preparatory work, to define search areas and identify potential areas of interest through dialogue with stakeholders and studying reports, is therefore crucial.

In 2021, ghost net projects were conducted in Blekinge and Kalmar Counties to get an overview of the situation. In addition to these two projects, documentation of ghost nets was also carried out on wrecks on the Swedish west coast, in Skånska Kattegatt, a marine nature reserve outside Kullaberg in Skåne County. The findings are disappointing.



*Unfortunately, this is a sight we encounter more and more often. Fish, seals, porpoises, and other animals face a painful death when caught in the nets.*


*Since 2018, Rena Botten has been conducting one cleaning dive per month in the Stockholm region during March-November.*



*Interviews with various stakeholders are very important in order to limit and prioritize search areas of interest for ghost nets.*

In Blekinge and Kalmar, we have noted ghost nets on about 70% of all dived objects. However, this is strongly correlated with depth. There are ghost nets on virtually all objects that are deeper than 30 m/100 ft. In Skånska Kattegatt, nets were documented on all seven wrecks visited.

## MORE WORK TO BE DONE!

In total, more than 60 participants spent about 50 days at sea searching for ghost nets and retrieving waste from the bottom in the two projects. In 2022, we will raise the bar; Rena Botten will carry out 16 cleaning events, aiming at recovering another 30 tons of waste. Operation Spöknät will continue to map and document ghost nets in the Baltic Sea in close collaboration with relevant County Administrative Boards. We also plan to retrieve nets from at least four wrecks in Skånska Kattegatt.

We look forward to a busy year at sea! Welcome to join any of our activities to contribute to a cleaner sea while developing your diving skills and having fun.

*Contact us at info@guesweden.se*

## DIVE TEAM

*GUE Sweden project divers*

## SPONSORS

*Operation Spöknät is financed with grants for local water management initiatives (LOVA funds from the Swedish Agency for Marine and Water Management) through the county administrative boards in Kalmar and Blekinge and directly by the County in Skåne. Rena Botten is financed by donations from individuals and companies around Sweden.*

# THE HIDDEN RIVER TEAM

*The Hidden River Project Team 2020*

*By Stephan Schlumbohm, photos by Sandra Fiehe and Torsten Schnitter*

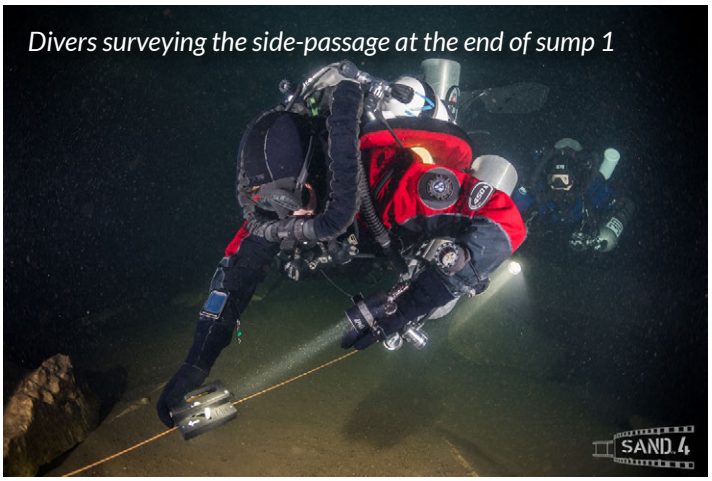
AS for many of us, the year 2020 was quite different compared to the past 10 years that we conducted our project at Reseau de l'Ouysse. This difference, of course, was due to the emerging COVID-19 pandemic in 2020 and its unpredictable development. We were unaware, until a few weeks before, if we would be able to run our project and, if so, how many team members would be able to participate. In September 2020, 11 members of the Hidden River Team met in southern France, Department Lot, to continue the exploration of the Reseau de l'Ouysse, known as the dive sites Résurgence de Cabouy / Gouffre de Pou Meyssen.

## THIS CAVE NEVER STOPS SURPRISING US!

The dry cave area behind Sump 2 (south passage) has been further explored and surveyed, including even a short dive at this remote spot. The dry cave in this area of the cave is very challenging due to its small passage size, and it results in a long and exhausting day trip.

The data from our four installed sensors has been collected (depth and temperature readings) as we have done since 2013. With a limited lifetime of the batteries, we must collect the data from the sensors annually to make sure we don't lose any of the precious data. So, these little helpful devices need our maintenance, no matter what.

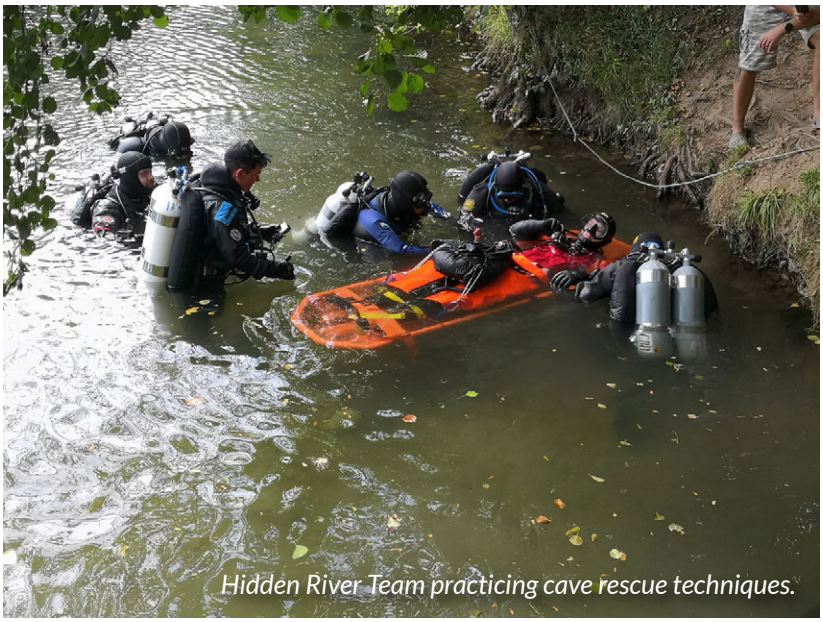
We have passed the end of sump 1 so many times in order to reach further into the cave, but we never invested the time to check that area in full detail. It was on our list of objectives for many years, but we never made it a high priority objective. This year, we finally invested our time and resources, and it paid off well: a new side-passage at the end of Sump 1 has been explored and surveyed. In total, 1,120 m/3,675 ft of new passage has been added to the existing survey and the map of the cave (https://www.thehiddenriverproject.org/downloads/Reseau_de_lOuysse.pdf).



*Divers surveying the side-passage at the end of sump 1*

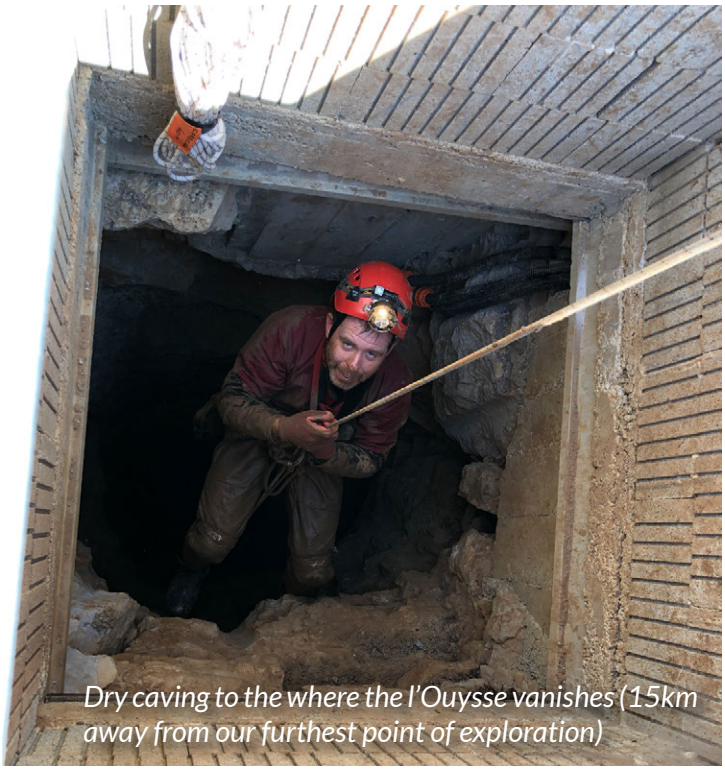

## CAVE RESCUE TRAINING

In addition to our exploration efforts, we also used our time to further practice our rescue technique, enabling us to transport a disabled diver over a longer distance inside a cave. We practiced not only on the different positions of the rescuers, but some team members also took the chance to act as the disabled diver to provide feedback for further improvements (https://www.facebook.com/watch/?v=155638499717092).


*Hidden River Team practicing cave rescue techniques.*

## THE OTHER SIDE

We were offered an opportunity to visit the restricted dry cave site, Le Bret, which leads through several vertical shafts to where the underground river l'Ouysse is last seen before it vanishes for approximately 15 km linear distance to meet us at our furthest point of exploration in Sump 3 again. The exciting trip to the other side of the l'Ouysse showed us again how much exploration potential the hidden river still has.


*Dry caving to the where the l'Ouysse vanishes (15km away from our furthest point of exploration)*

## DIVE TEAM

*D. Beiert, S. Bertelmann, M. Buchs, C. Buehler, S. Fiehe, O. Gobara, I. Homberger, J. Medenwaldt, M. Miethke, S. Schlumbohm, T. Schnitter*

INDONESIA

# THE REVIVAL OF BALI'S DEGRADING REEFS

## LIVING SEAS CONSERVATION PROJECT

*Livingseas conservation project in Baung Penyu, Bali (2021) showing the increase of biodiversity as a result of new corals planted*

*By Cleine Celestine and Albert Tamin*
*Photographers: Leon Boey and Cleine Celestine*

THE growth of the Livingseas Conservation Project here in Padangbai, Bali, has been very satisfying to see. Divers who visit our site remark at the difference in size between corals that have been planted three years ago and the ones that are newly planted.

Most visitors comment that they are surprised and impressed at how large an area we have covered with new reef. Sometimes we would look at the site and think about how gracefully the corals have overgrown the structures.

Our overall goal is to cover one hectare of seabed in Padangbai. Thus far we have achieved a total coverage of 550 square meters, corresponding to 837 reef star structures, the majority of which were planted within the last year.

On the older structures, we can hardly see the metal structures anymore because of how big the corals have grown. It doesn't even look like an artificial reef!

Despite how well the corals have grown, the work is still far from finished. Currently, we are actively working on getting more partnerships with NGOs, community groups, companies, and individuals who are keen to contribute to the preservation of the ocean.

We have also realized that there is still a lack of awareness in most people about the importance of marine conservation. Thus, we have been spreading awareness to the local community here in Padangbai through a new social impact program that we have developed.

## A NEW APPROACH TO SUSTAINABLE CONSERVATION

Bali is known as a diver's paradise because of its beautiful healthy reefs. Unfortunately, that is no longer the case.

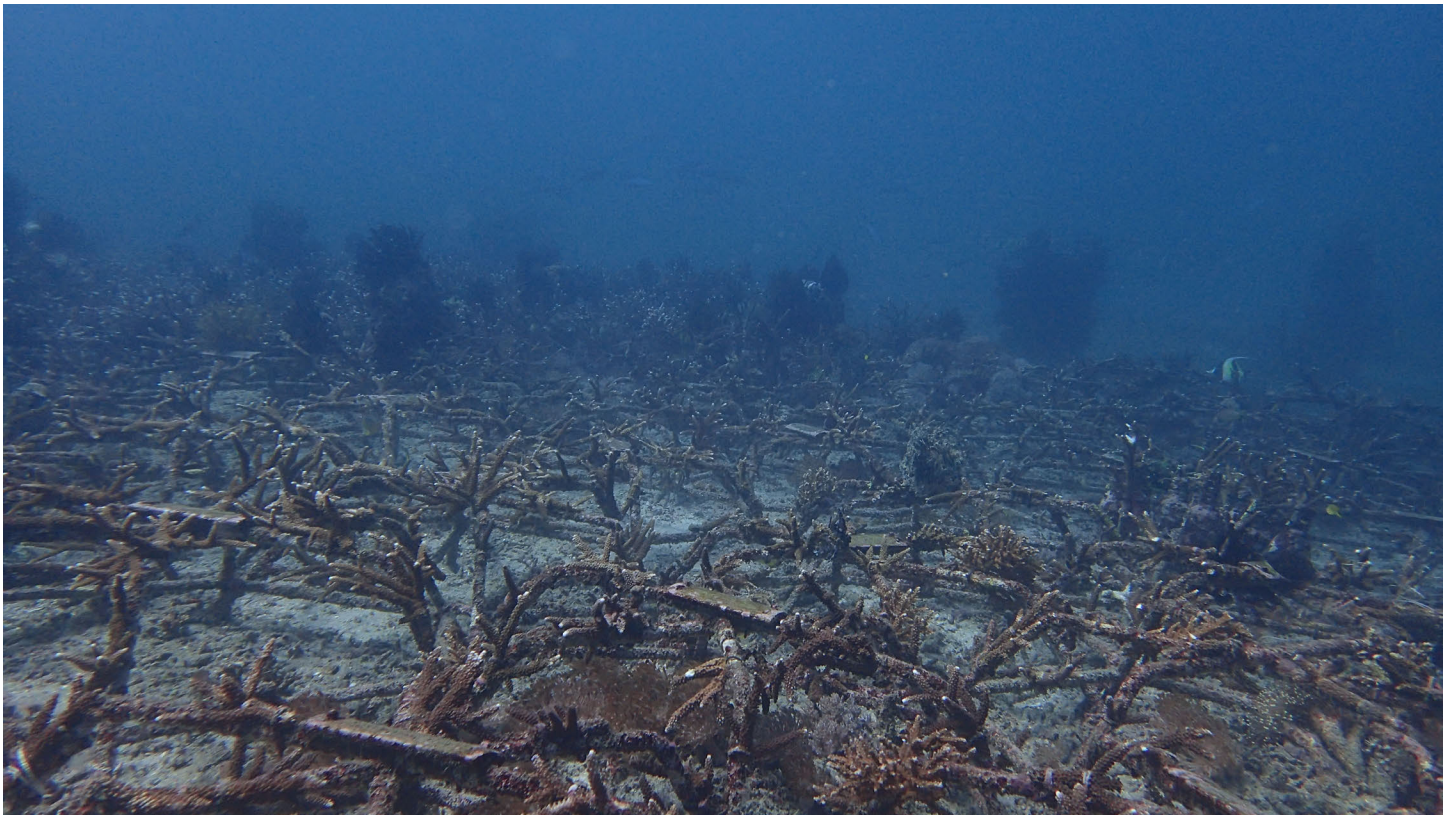
Due to climate change, improper waste management, and over-tourism, the reefs in Bali have endured a lot of stress, resulting in many reefs being pushed to the brink of destruction.

If this devastation continues without intervention, the reef's natural rate of replenishment will never be allowed to match its mortality rate, and the reefs in Bali will be faced with extinction.

Livingseas has been working on this issue for quite some time. In 2018, we began our project on a small scale, with only 20 reef star structures at Mimpang Rocks. As of January 2022, with the help of our diving community and corporate sponsors, Livingseas has managed to install a total of

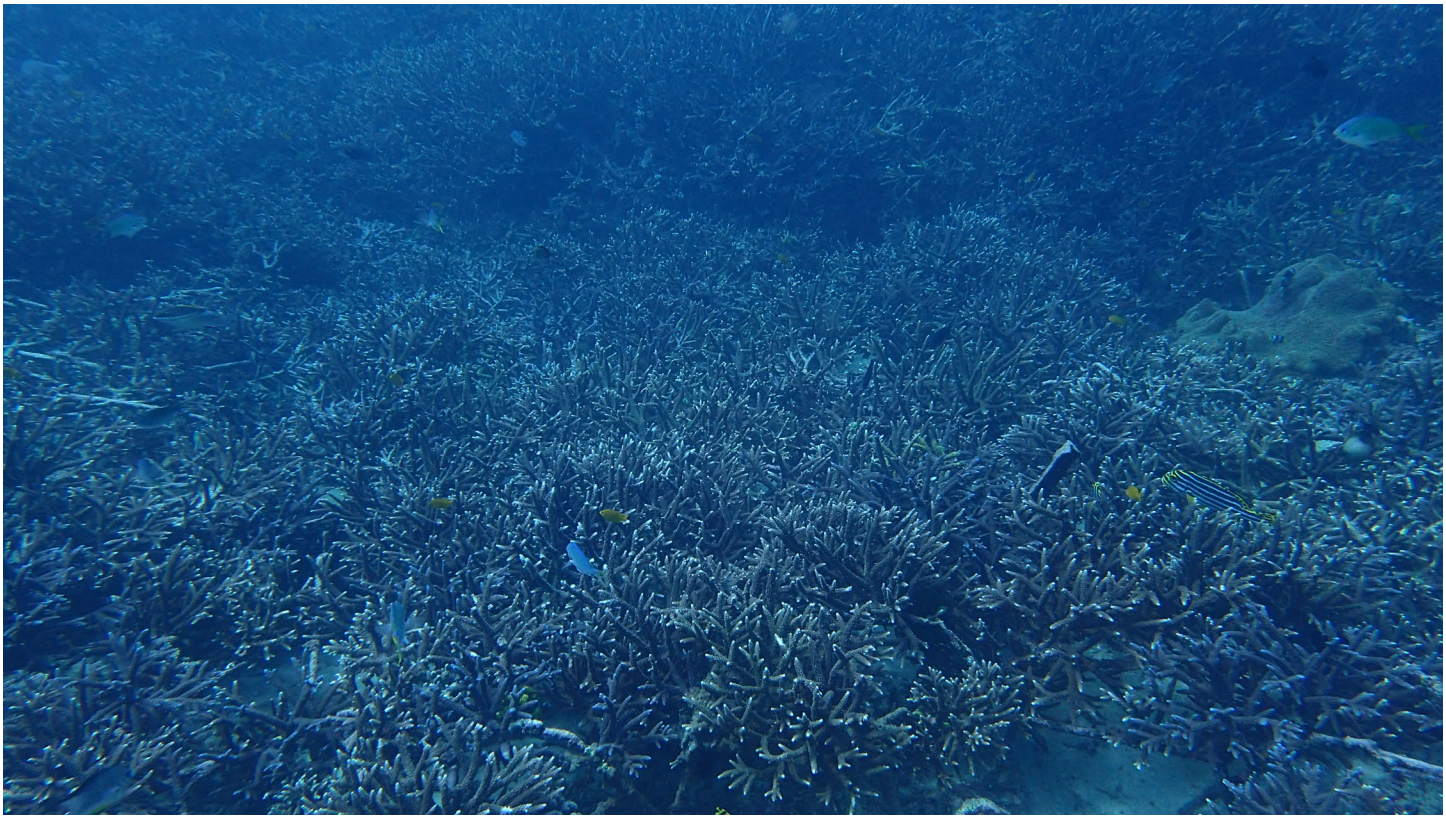
*Tika (left) and Eka (right) attaching corals to their reef stars*

*A baseline picture of one of Livingseas' conservation sites before our restoration efforts in the area (2019)*



*The same site after 18 months of conservation work (2021). Note the increase in marine biodiversity in the area.*

*Livingseas' first-ever conservation project in Mimpang, Bali (2018)*



*The same site in Mimpang, Bali, 3 years later (2021)*

837 reef stars in four different sites around Jakarta and Bali, resulting in 550 square meters of new reef created.

From our experience, we realized that the local community holds the most important role in any conservation effort. That is why we are taking a new approach to create sustainability in conservation by building a local community that recognizes the importance of conservation and is willing to put in the effort to minimize the impact on the future. We are working to normalize a conservation mindset through education and by imparting a sense of ownership of these issues.

We want the local community to have its independence in making better, more sustainable choices while understanding its dependent relationship to the ocean, because everything starts and ends with the ocean.

Once they realize how important taking care of their environment is, it will become a part of their culture and this knowledge can be passed down from generation to generation.

## PASSING IT ON TO THE NEXT GENERATION

In order to achieve this goal, we created a Fellowship program in collaboration with a local NGO for the local youth of Padangbai, Bali.

The program was designed to teach local female youth how to dive and learn about conservation work. We sponsored six women on dive training, from Open Water to Coral and Fish identification.

We want them to be able to see firsthand what is going on beneath the waves, something not many locals have the privilege to see. By giving them this opportunity, they can appreciate and care more about the various impacts that the reef is facing.

Now that they have been trained in proper stability and diving techniques, they are actively helping to replant the coral with us. We are also training them on how to present what they have learned about the ocean to other community groups around the area as a way to spread awareness about ocean conservation.

On November 19th, 2021, we organized a hands-on coral planting activity that involved over 50 people from the village and was led by the Fellowship mentees. This is something new and different for the local community, and they were very excited and happy to participate and learn about coral planting.

*Learning how to dive over the conservation site in Baung Penyu.*

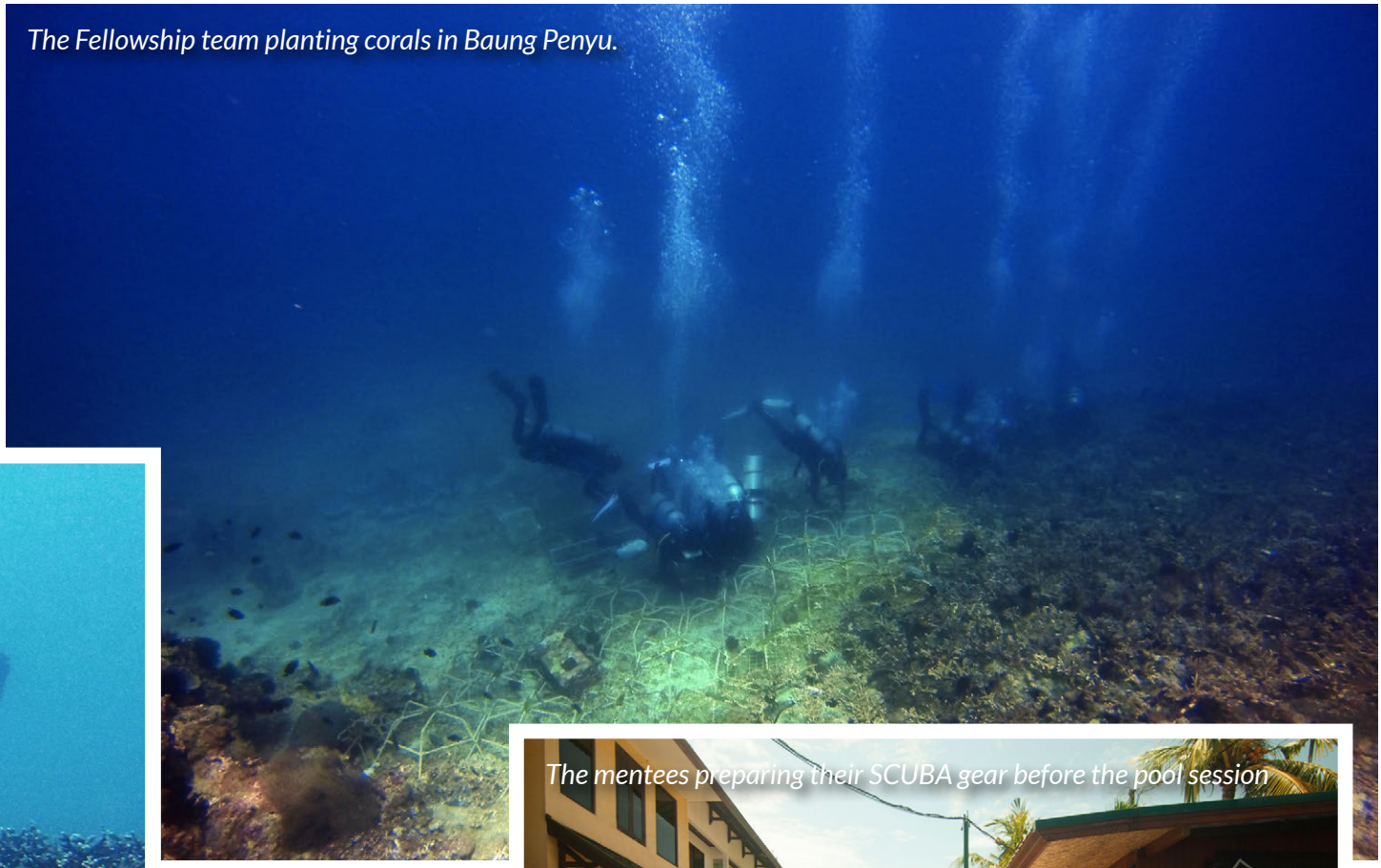
## DIVE TEAM

*Leon Boey, Putu Agus Triawan, Aryo Damar, Albert Tamin, Cleine Celestine, Kadek Budiarta*

## SPONSORS

*Livingseas, Kopernik, Ocean Purpose Project, Mandarin Oriental Hotel Jakarta, CarbonEthics, and many other individual ocean lovers*

*Livingseas conservation website*



*The Fellowship team planting corals in Baung Penyu.*


*The mentees preparing their SCUBA gear before the pool session*

*The Fellowship Program first batch (Left to Right: Gita, Dede, Saras, Eka, Tika, and Praba)*

MEXICO

# EXPLORING IN OX BEL HA THE LOS PANTANOS AREA

## BEL EXPLORATION

PHOTO TOM ST. GEORGE


*The furthest point of penetration from the entrance was 4 km/2.4 mi. This was achieved with long -range scooters.*


*Lacking any other closer access point, we used Cenote Yax Chen upstream and downstream entrance.*

*By* Emőke *Wagner, Bjarne Knudsen, Laszlo Cseh Photographer: Tom St. George*

OX Bel Ha is the second largest underwater cave system in the world. Although it has been actively explored since 1998 by different groups of divers, the cave is steadily growing, new areas are discovered every year, and the exploration process seems unlikely to end anytime soon.

The COVID pandemic impacted Mexico, but after the local lockdown was lifted last year, our dive team decided to seek out new areas in the system for potential cave exploration. There were only the three of us: Emőke and László (originally from Hungary but living in Mexico for some years, active GUE cave instructors), and our dear friend Bjarne from Denmark (GUE cave diver and previous WKPP member). Facing access issues immediately after quarantine, our team chose a cenote called Yax Chen ("blue or green well"), part of the OBH cave system that seemed to be open to divers as if there were no pandemic at all. We're talking about a massive section of cave that ventures many kilometers inland, where it adds 10 km/6.2 miles of different sections to its main tunnel. It also features a lesser known and less extensive downstream section, so just getting to a new cave in an area like this can be quite a challenge.

Since Ox Bel Ha is a giant cave system, we decided—as always—to resurvey all existing lines, which was going to be interesting since our team had no data from the area. After a few months of survey in the early fall of 2020, we finally had a major breakthrough about 2 km upstream, through a collapsed room, under a ledge the cave opened up into 10-15 m/33-49 ft wide rooms with a floor to ceiling distance of 3-4 m/10-13 ft. We ran out of line quickly, knowing we had some cool exploration ahead but having no clue that this discovery would establish a new 20.3 km/12.6 mile section of the system!

We explored the cave further upstream while documenting side tunnels and checking out other interesting leads. With the advent of electronic survey tools like Mnemo, using unknotted lines in the cave has become more prevalent in local cave exploration. Directional markers in the newly explored area have been labeled "BEL" to represent our first initials, and "Bel" in Mayan translates to "path." It's very fitting, since the three of us were trying to find new paths in the cave every day.

On each dive, we got progressively farther from our nearest entrance. The system is very complex; it has a lot of sediment, and the tunnels don't


*Mnemo electronic survey device helped us collect information even in low visibility conditions where the traditional survey techniques would be difficult or inefficient.*


PHOTO TOM ST. GEORGE

*During the exploration project, GUE standardized backmount and sidemount configurations were used as the environment dictated.*

remain wide over long distances. We can't count on our fingers the number of times we thought the exploration was over, decided to do one more dive, and pushed through a nasty and tight restriction to find a few more kilometers of cave. During the first half of 2021, we were actively diving the area and we were able to discover many kilometers of new cave.

Penetrating further north from the new lines, we were able to establish six new connections between Yax Chen and the historic section of Ox Bel Ha, and new a connection between the upstream and downstream of the Yax Chen area. The team also discovered two new cenotes along the way. They were named Yax Ich which means "green eye," and K'aas Naay, or "bad dream."

As we started to get boxed in by the historic lines and acquiesced to the salt water that "killed" our tunnels on the west side, we realized that all good things—this amazing, laborious experience included—must come to an end.

## DIVE TEAM

*Emőke Wagner, Bjarne Knudsen, Laszlo Cseh, Daniel Riordan*

## SPONSORS

*Cuzel filling station, Dr. Mario Valotta*

## EXPLORATION TIME:

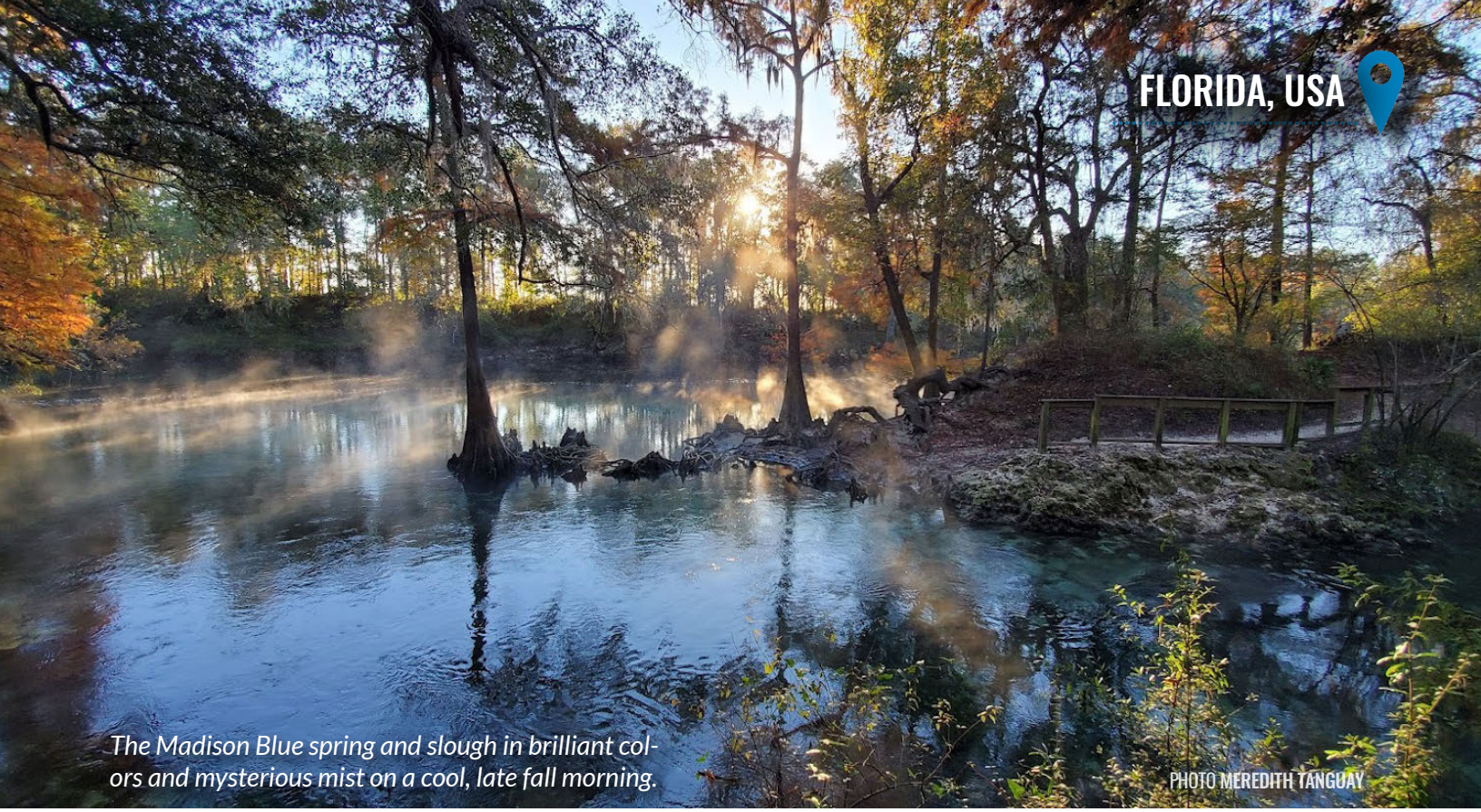
*September 2020 - May 2021*

## EQUIPMENT WE USED:

*GUE standard backmount and sidemount configuration, SUEX DPVs, Mnemo survey tool*

## TOTAL NEW EXPLORATION LENGTH:

*20.3 km/12.6 miles*




*The Madison Blue spring and slough in brilliant colors and mysterious mist on a cool, late fall morning.*

PHOTO MEREDITH TANGUAY

# MADISON BLUE CAVE RE-SURVEY

*By Meredith Tanguay*

**LOCATED** in northern Florida, Madison Blue Springs State Park was voted one of America's Best Swimmin' Holes. This State Park is also a popular cave diving location subject to frequent reversing when the Withlacoochee River rises. Karst Underwater Research (KUR), under a Scientific Research Permit issued by the Florida State Parks Service, is conducting a detailed, multi-year re-survey of this system. Multiple surveyors, including several GUE divers, have contributed survey data to this project going back at least as far as 2012.

In December 2021, Tom Nelson and GUE diver Meredith Tanguay conducted a multi-hour survey dive in the Crossunder Tunnel, collecting over 300 m/1000 ft of survey distance data and tie-ins totalling more than 50 stations. Distances were measured with fibertape, and both passage dimensions (LRUDs) and side passage locations were documented. This was Tanguay's fourth data contribution as surveyor for this project.

This survey project is ongoing with the primary coordinators: Bob Schulte, Ken Sallot, and Charlie Roberson.

## DIVE TEAM

*GUE Diver Meredith Tanguay – surveyor, Tom Nelson – teammate*

## SPONSORS

*Karst Underwater Research is a 501(c)(3) nonprofit organization and is sponsored by: Divesoft, Fathom Dive Systems, Dive Rite, Golem Gear, Dive Long Intersorb, ScubaForce USA, Stay Dri Scuba, Diver City, and Aqua Vertical.*

IRELAND

# MALIN HEAD

## DONEGAL, IRELAND

PHOTO GRAHAM BLACKMORE

*This photograph of the U-2506 at about 65 m/213 ft gives an idea of the scale and visibility of the wrecks to be found in Malin Head diving. Sand/gravel bottoms and clear Atlantic waters give divers the opportunity to take in the wrecks found in the area.*


Empire Heritage *spilled its cargo over the bottom in 65 m/213 ft+ waters. Here we can see tanks, which are incredibly well preserved, forming a scene like a pretend battle on a child's bedroom floor, only it's full-sized.*

*Text and photos by Graham Blackmore*

**WHEN** people think about wreck diving, often exotic locations spring to mind—like Chuuk Lagoon in the Pacific—but wreck diving in the British Isles and Ireland is arguably some of the best in the world, with a rich maritime heritage going back hundreds (even thousands) of years and including some notable casualties from two World Wars. Malin Head is the northernmost point of Ireland, and it is used as a catch-all to describe the diving from Northern Ireland (including Donegal), and is the crown jewel of Irish/British diving.

Oceanic conditions give amazing visibility with a tradeoff of challenging surface conditions (pack your seasickness tablets), with wrecks found in the 40-160 m range (140-525 ft.) 2021 would be my 4th week of diving in the area, and so-called classics are never bad dives, but with increasingly more interest and a stronger relationship with skipper, a chance to start diving and identify unknowns in the area. In the past, divers have traveled from all over the world, but last year largely German and British groups of divers explored the wrecks. This year, 2022, beckons with three weeks of diving available for CCR divers suitability experienced in the 60-100 m (197-328 ft) range and deeper.

## DIVE TEAM

*Graham Blackmore, Steffen Scholz, Joe Tidball, James Sanderson, Peter Ellwood, Stephen Elves, Gregor Malessa, Markus Kerwath*

# EXPLORING TWILIGHT REEFS

## OKINAWA PROJECT

*By Frederic Sinniger Harii, Thomas Jonsson, Matt Broughton*

**OKINAWA** Island in southern Japan is located in the middle of the Ryukyus, an archipelago connecting mainland Japan to Taiwan. Its unique location under the direct influence of the Kuroshio current coming from the south and flowing north through the archipelago provides the island with ideal conditions for coral reef development. However, the combination of global climate warming and local anthropogenic pressure (e.g., rapid urbanization of the coastlines and pollution) has put the coral reef ecosystems at risk.

While the shallow reefs in the region are relatively well known, the deeper parts of the reef, from 30 m/100 ft down to over 100 m/328 ft, remain mostly unexplored. Preliminary surveys in Okinawa suggest that these ecosystems, referred to as Mesophotic Coral Ecosystems (MCEs), host a rich biodiversity of both unique deep-adapted species and shallow species that could possibly find refuge there from increasing temperatures at the surface. To provide the first detailed biodiversity study of these mesophotic ecosystems, the National Geographic Society funded a project from the University of the Ryukyus to explore these unique ecosystems in the region.

The new species described and sequenced through this project will provide important information to better understand marine biodiversity and how organisms are distributed in the tropical and subtropical western Pacific Ocean, which will, in turn, be helpful for planning sensible coastal urban development in the region.

### ENTER COVID-19...

The original plan was to gather a team of international marine biology researchers capable of conducting deep dives. Sonia Rowley of the University of Hawaii and Gael Lagarrigue, a diver from the Under the Pole DeepHope expedition, were keen to join the project; however, due to restrictions in travel, neither could come to Japan, delaying the project. In parallel, the principal investigator, Frederic Sinniger Harii, began to sort out project logistics by talking to Thomas Jonsson, one of the local GUE instructors in Japan. At the end, considering the logistical challenges of conducting deep technical dives in Japan, Frederic realized that the only way to start the project was to collaborate with deep divers based in Japan, of which there are not many.

*GUE Diver Nicholas Honda measuring a gorgonian coral.*

PHOTO THOMAS JONSSON

Ahead of the timeline, the first dives were planned with Thomas and Matt Broughton, another local GUE instructor, with the goal to check the sites of interest for coming dives, evaluate the risks, and to sample coral species of interest. Thomas and Matt could document and describe conditions at the sites but had no experience in sampling coral for scientific analysis. Several online meetings were held in the Tokyo area, where Thomas and Matt regularly dive, to discuss this part and test dives, with sampling limited to

*GUE Instructor Matt Broughton sampling coral for sequencing.*

PHOTO THOMAS JONSSON

pictures. The local community of GUE divers, including Nicholas Honda, Tomo (check) Murakami, Radek Lanc, Patrick Kishino, and Raeni Liu, supported and contributed input on these dives.

## THE FIRST DIVES

In July 2021, with a permit in hand issued to sample corals by the Okinawan government, Thomas and Matt traveled to Okinawa to do the first dives in the 70-80 m/230-266 ft range. Despite preparations and long discussions on what to sample, few samples were recovered, including some that were not even coral!

"I was lucky to be the video photographer. I could see Matt being very reluctant to sample the first coral and could feel the pain he was feeling using the chisel on a magnificent reef." Thomas Jonsson, GUE instructor and project member.

While we reached our first goal—to document and describe the dive sites—we had much to learn about sampling corals, even with Frederic motivating us by saying we had sampled a possible new species and had found species never reported at that depth before in Japan. With our tail between our legs, we went back to Tokyo eager to improve our sampling speed and precision, while Frederic on his side worked to improve the documentation and clarify the targeted organisms for the next step of this research.

## THE SECOND DIVES

October 2021 and back to Okinawa. This time with improved sampling equipment, introduced to us by the experienced Sonia Rowley, and a well-rehearsed documentation and sampling methodology. Frederic's briefings and sample reference cards to attach to Thomas and Matt's DPVs were valuable time savers. Thomas and Matt set a stretch goal—to identify, document, and to collect one sample for every minute of bottom time.

"Never underestimate the importance of preparation. Taking the time on the surface to better label and organize our Ziploc sample bags saved us precious bottom time." Matt Broughton, GUE instructor and project member.

Thankfully, the time and effort spent practicing and preparing paid off, and we had very successful dives collecting numerous samples to send back for sequencing. Success!

## LEARNINGS

This was a great example of multidisciplinary teamwork. The divers were taught by the scientists on what to sample and what needed to be

documented, and the divers explained specifics of a deep, closed-circuit rebreather dive to the surface support and scientists..

"Having two non-scientists join the team has been an enormous asset for this project, especially with the skills and motivation of Matt and Thomas. We all learned a lot from each other." Frederic Sinniger Harii, Project Leader, University of the Ryukyus Tropical Biosphere Research Center.

The logistics of setting up dives at these depths in a remote recreational diving location was challenging. With much uncertainty related to international travel to Japan, this collaboration between Global Underwater Explorers and a National Geographic Explorer allowed the project to go beyond test dives to provide high quality data for this mesophotic research. Deeper dives and new sites are planned for March 2022, with Thomas and Matt constantly improving their knowledge on these ecosystems and their skills in scientific diving. In July 2022, more intensive deep explorations are planned with the GUE divers and hopefully the international divers this time. To be continued…

## PROJECT MEMBERS

*Frederic Sinniger Harii, Sonia Rowley, Thomas Jonsson, Matt Broughton*

## DIVE SUPPORT

*Ritzelle Lima Albelda, Nicholas Honda, Patrick Kishino, Radek Lanc, Raeni Liu, Tomo Murakami, Tim Reynolds*

## SPONSORS

*National Geographic Society, University of the Ryukyus Tropical Biosphere Research Center*

*GUE Instructor Matt Broughton heading towards a target sampling site at 80 m/262 ft.*

PHOTO THOMAS JONSSON

# FIND YOUR COMMUNITY EVERYWHERE YOU GO


**PREMIUM DIVE CENTERS**

Deepstop – Schwetzingen, Germany
Dive Centre Bondi – Bondi, NSW, Australia
Duikcentrum de Aalscholvers – Tilburg, Netherlands
Eight Diving – Des Moines, WA, USA
Extreme Exposure – High Springs, FL, USA
Living Oceans – Singapore
Living Oceans Malaysia – Kuala Lumpur, Malaysia
Plongée Nautilus – Quebec City, QC, Canada
Portofino Divers – Portofino, Italy
Qiandaohu Diving Center – Hangzhou, China
Scuba Academie – Vinkeveen, Netherlands
Tech Korea – Incheon, South Korea
Zero Gravity – Quintana Roo, Mexico

**DIVE CENTERS**

Acuatic Tulum Dive Center – Tulum, Mexico
Buddy Dive Resort – Bonaire
Dive Alaska – Anchorage, AK, USA
Diveolution – Kessl-Lo, Belgium
Freestyle Divers – Fujairah, United Arab Emirates
Hollywood Divers – Los Angeles, CA, USA
Islas Hormigas – Cabo de Palos, Spain
Kasai Village Dive Academy – Cebu, Philippines
KrakenDive – Tossa de Mar, Spain
Krnicadive – Krnica, Croatia
Moby Tek Dive Centre – Pahang, Malaysia
Ocean Blue Wave – Bangkok, Thailand
Red Sea Explorers – Hurghada, Egypt
Scuba Seekers – Dahab, Egypt
Silent Bubbles – Stockholm, Sweden
Tauchen und Freizeit – Wuppertal, Germany
Tauchservice Münster – Münster, Germany
Tech Asia – Puerto Galera, Philippines
Werner Lau - Sinai Divers Tek – Sharm el Sheikh, Egypt

UNITED KINGDOM

# A YEAR OF CITIZEN SCIENCE

## PROJECT BASELINE UK

*By Marcus Rose*

PROJECT Baseline has maintained a footprint in the UK for over eight years now, with teams focusing on specific local sites and monitoring conditions over an extended period of time. This is valuable work, and a number of local teams continue to operate in the UK, monitoring wreck sites, freshwater habitats, and even specific marine species.

During the first national lockdowns in the UK, whilst others were buying lockdown puppies, three divers from the UK decided more could be done to support aquatic conservation in the UK. As a result, Project Baseline UK (PBUK) was formed, with the aim of providing additional support to those teams that want it and in the hope that more ambitious collaborative efforts could be formed with non-governmental conservation groups and with university researchers.

In the first year of PBUK, the achievements have exceeded expectations. As well as supporting British teams, PBUK has collaborated with the Ocean Conservation Trust in its seagrass restoration efforts, contributed to university research into microplastics and antibiotics, and conducted the first UK collaborative mission with the Blue Marine Foundation.

### UNIVERSITY RESEARCH

#### DIVE FOR ANTIBIOTICS

One of PBUK's longest running collaborations is with Strathclyde University and Dive for Antibiotics (DFA). Decent collaborations can often be hard to come by; however, this one came about by chance when a student from the University got involved in the local diving community. This led to introductions being made, and the mutual benefit of divers working with researchers was identified. For the divers, collecting sediment samples adds a sense of purpose to their diving, and for the researcher, it provides a high volume of data points.

Actinobacteria produce a huge number of antibiotics, but scientists are no longer discovering new species and new antibiotics. With most terrestrial sources exhausted, researchers at the university are looking to the marine environment to widen the search. As the human population's immunity to antibiotics increases, finding new sources becomes increasingly more important.

The fantastic part of the collaboration with DFA is the ability to see the results of the research. DFA has created an Instragam page where divers can track the progress of research into their specific sediment samples using unique serial numbers. It is worth visiting this on Instagram, as the processed samples produce some surprisingly colorful ilsolated colonies on the Petri dish.

#### MICROPLASTICS

At the start of 2021, PBUK was lucky to be introduced to an MSc student at the University of Chester who was doing research into the distribution of microplastics. This was a perfect collaboration for PBUK, as the university was looking for marine sediment to analyze for plastics. The geographic distribution of PBUK divers meant that the volume and distribution of the collection was far greater than the university could achieve independently.

Working with the university, PBUK produced a sediment collection process that was shared with volunteer divers. Sediment was collected from many sites on the south coast of the UK and around Scotland, including the remote Shetland Islands, and in a range of depths. Once collected, the samples were logged into a database and sent to the University for analysis.

*PBUK Trustee and Project Diver Marcus Rose conducting a video transect to capture the benthic species at this survey site.*

PHOTO **OWEN FLOWERS**

*Project Divers Alana Dempsey, Stephen Symington, and PBUK Trustee sharing their experiences from the day's diving and showing the benefit of project diving within the community.*

PHOTO OWEN FLOWERS

*An image taken at one of our survey sites for social media/outreach.*

PHOTO OWEN FLOWERS

PHOTO MARCUS ROSE

*Project Diver Graham Blackmore returning from a project dive. The camera mounted on the Suex DPV is used to collect wide area video survey data.*

The research into the samples is still in its infancy, but initial findings showed some surprising results. The highest concentrations of microplastics in the sediment were not close to human settlement or water discharge areas; instead, they were often in more remote locations. The concentration of plastics in the Shetland Islands was a particular surprise given its distance from heavily populated areas. The reason for this is unknown, but initial suggestions are that the oceanographic conditions (especially water movement) likely have a bigger impact on where microplastics settle than simply the proximity to where they entered the sea.

PBUK is now in discussions with the university about plans for 2022. There is an ambition to develop the research over the next few years, with the aim of publishing the results in an academic journal once it is complete. Any divers interested in supporting this research should contact PBUK, as the University of Chester is keen to expand collection efforts outside of the U.K.

## COLLABORATIONS

### OCEAN CONSERVATION TRUST

Throughout 2021, PBUK divers teamed up with the Ocean Conservation Trust and Life Recreation Remedies to support a seagrass restoration project in Devon and Cornwall, on the South Coast of the UK.

Divers assisted with habitat surveys, to find suitable sites for restoration and to identify seagrass that could be "harvested" for seeds. The latter surveys were especially important, as not all seagrass beds are reproductively active. Divers were tasked with conducting 30 m/100 ft long surveys, counting the number of reproductive shoots contained within each square meter of the transect. The reproductive shoots were identified by the presence of small seeds that look like bubbles. Initially, these can be difficult to spot as they are heavier than the other blades of seagrass and so sink to the seabed. However, once divers have their "eye in," it becomes much easier. This data


*Project diver Curtis Wadey reels in the tape measure following a video transect.*

PHOTO MARCUS ROSE

was used to determine where future seed collection dives would take place.

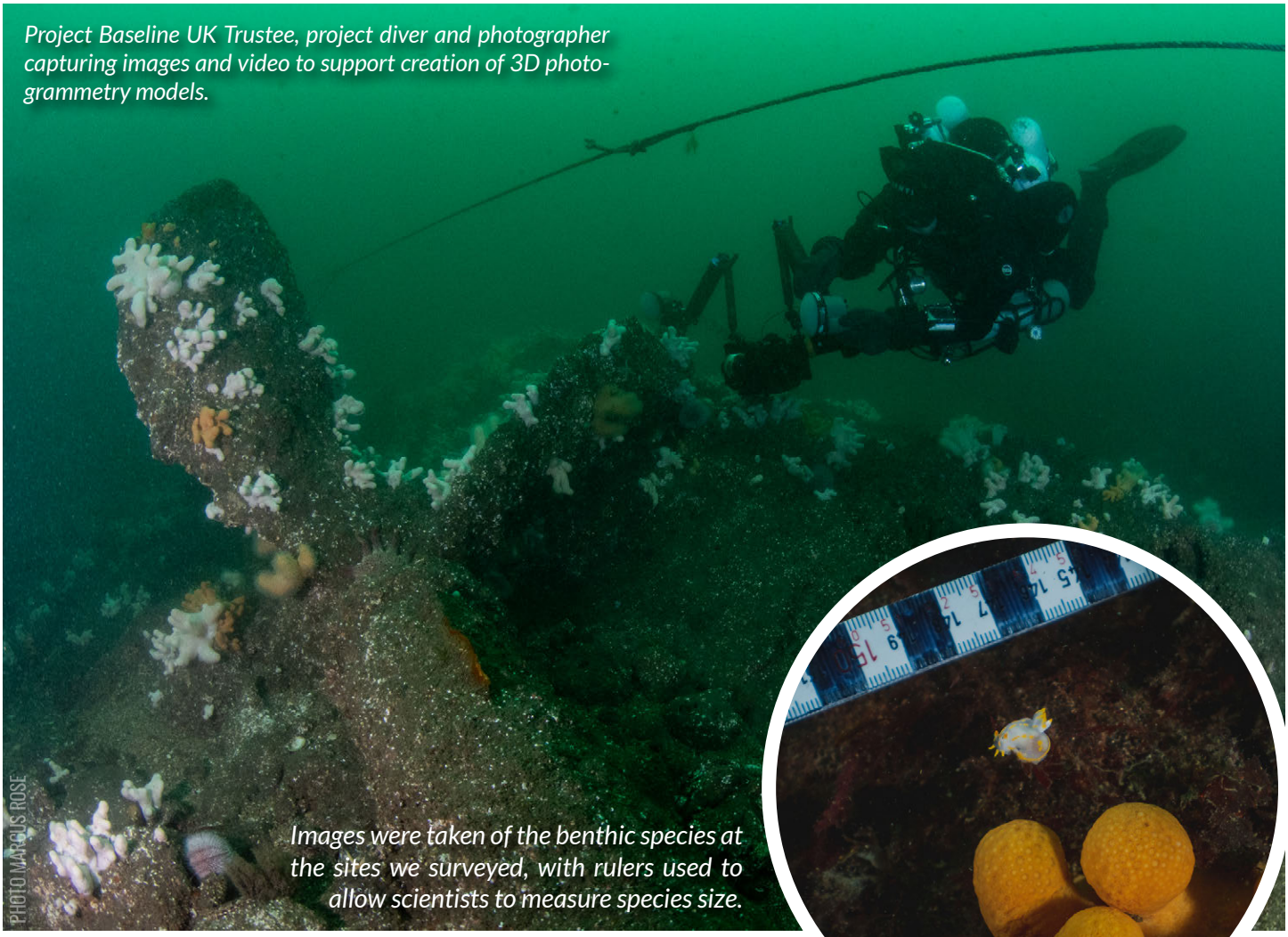
Once the environmental conditions were right, PBUK divers headed back to the best sites to collect the previously surveyed seeds. The task of picking seagrass seeds is not as easy as it sounds. Given that seagrass is usually found close to shore in water less than 10 m/33 ft (and often as shallow as 2-3 m/6-10 ft), the visibility was often poor. To make it more challenging, the currents in the locations chosen meant divers would drift over the seagrass beds so they would have to identify and pick the reproductive seeds before being carried away by the current. On returning to the boat, there was some healthy competition to see who had the biggest haul of seeds!

Once collected, the seeds were taken to a laboratory in the Plymouth Marine Aquarium, where they were cultivated by scientists until they were ready for planting. The seeds were then packed into small hessian sacks, using an army of volunteers, and deployed by scientists to the areas previously identified for restoration. It will be interesting to go back next year to see how effective this technique has been.

## BLUE MARINE FOUNDATION

The highlight of 2021 for PBUK was a collaborative mission with the Blue Marine Foundation (BLUE), in the waters along the Berwickshire coast. Berwickshire is situated on the east coast of the UK around the England-Scotland border. Inspired by Project Baseline's Nekton Mission collaboration, this UK-first saw PBUK divers run a dedicated data collection week, with funding and support from both BLUE and the British Sub-Aqua Jubilee Trust.

The sea by the town of Eyemouth and Berwickshire more widely have a number of marine protected areas, all with different restrictions on fishing activity, but with very little enforcement in place. As a result, many years of heavy fishing have had an impact, and BLUE is working with the fishermen to introduce more sustainable practices.



*Project Baseline UK Trustee, project diver and photographer capturing images and video to support creation of 3D photogrammetry models.*

PHOTO MARCUS ROSE

*Images were taken of the benthic species at the sites we surveyed, with rulers used to allow scientists to measure species size.*

PHOTO OWEN FLOWERS

They had success using this model in Lyme Bay on the south coast of the UK and are trying to replicate that success in Eyemouth.

The project came about following BLUE's efforts with the University of Plymouth to baseline marine habitats in the Berwickshire area using towed video. Whilst this collection method allowed large areas to be covered, it couldn't be used near underwater obstructions such as wrecks or pinnacles. To fill in the gaps in their data, BLUE asked PBUK to conduct video transects at these sites.

Even though the weather brought the mission to a premature end, the team spent three days conducting video transects, photogrammetry, habitat characterization, and identification of species of interest. The dive sites themselves were typically centered around wrecks in depths from approximately 15 m/50 ft down to 50 m/164 ft. Three teams of divers collected data on each site. On most dives, the teams had multiple goals, but generally one focused on a 50 m/164 ft long video transect, another conducted photogrammetry and the third completed wide area surveys using DPVs. However, ambitious attempts by the DPV divers to conduct multiple transects in a single dive, using SMBs to mark transect start and stop points, needs some work for next year! The confusion in the surface support team as SMBs went up and down meant that the process was less than successful.

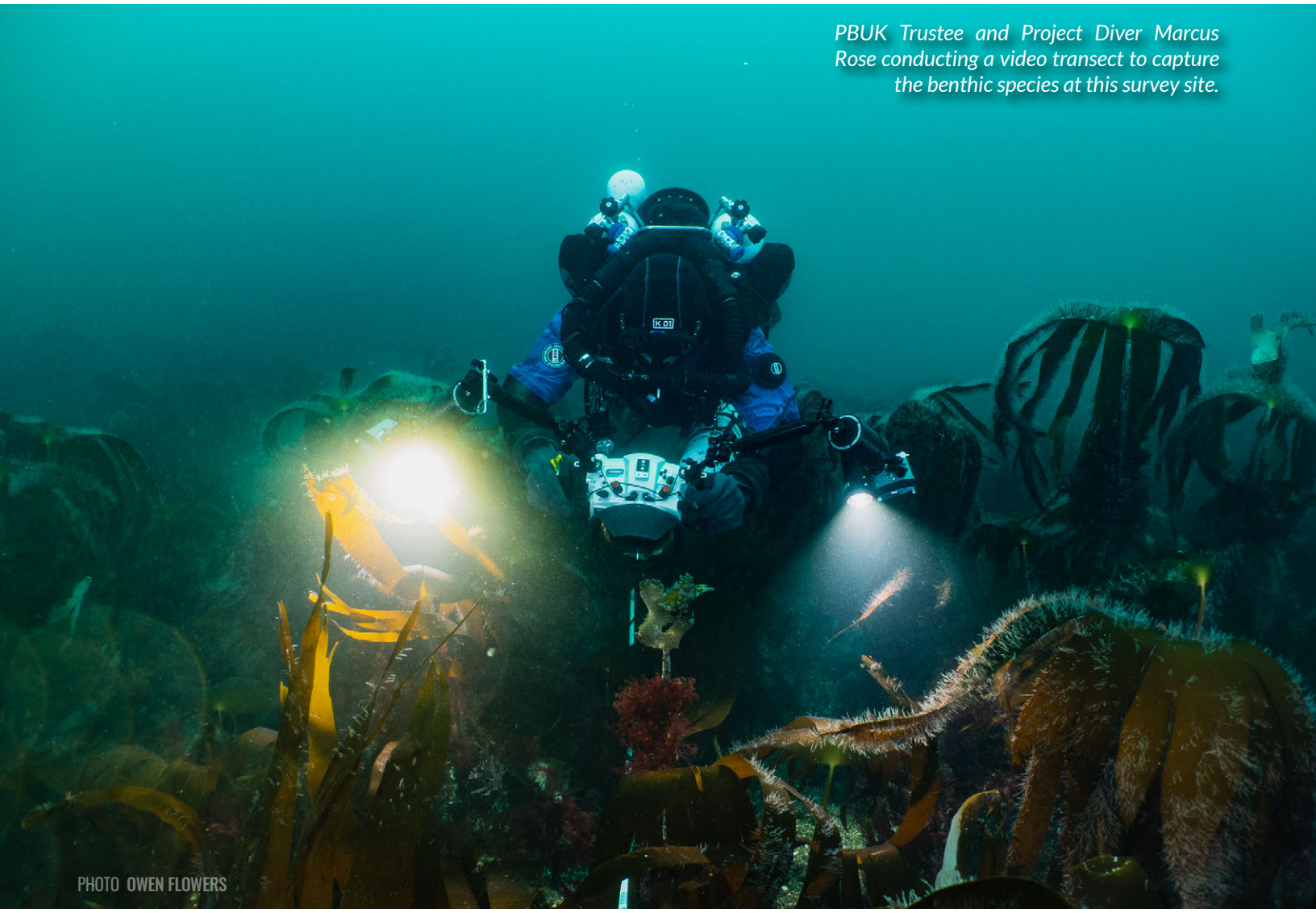
The data collected during the 2021 mission has been sent to the University of Plymouth for detailed review, and the findings will inform collection efforts in 2022. It is hoped that future missions in Eyemouth will have direct support from the University to allow more targeted data collection throughout the week.

Initial findings from the week showed that even the seabed within the "protected" areas around Berwickshire was often devoid of sealife. This could be seen quite clearly on the video transects, with fewer and fewer species present on the seabed as the distance from obstacles, such as the wrecks, increased.

In addition to the data collection, BLUE and PBUK hosted an outreach event with several like-minded groups presenting on their conservation efforts in the area. This was a great way to promote each other's work, but also to identify how we can work together in the future. During the evening, there were presentations on PB efforts with the Nekton Mission, presentations from the Berwickshire Marine Reserve, and St Abbs Marine Station.

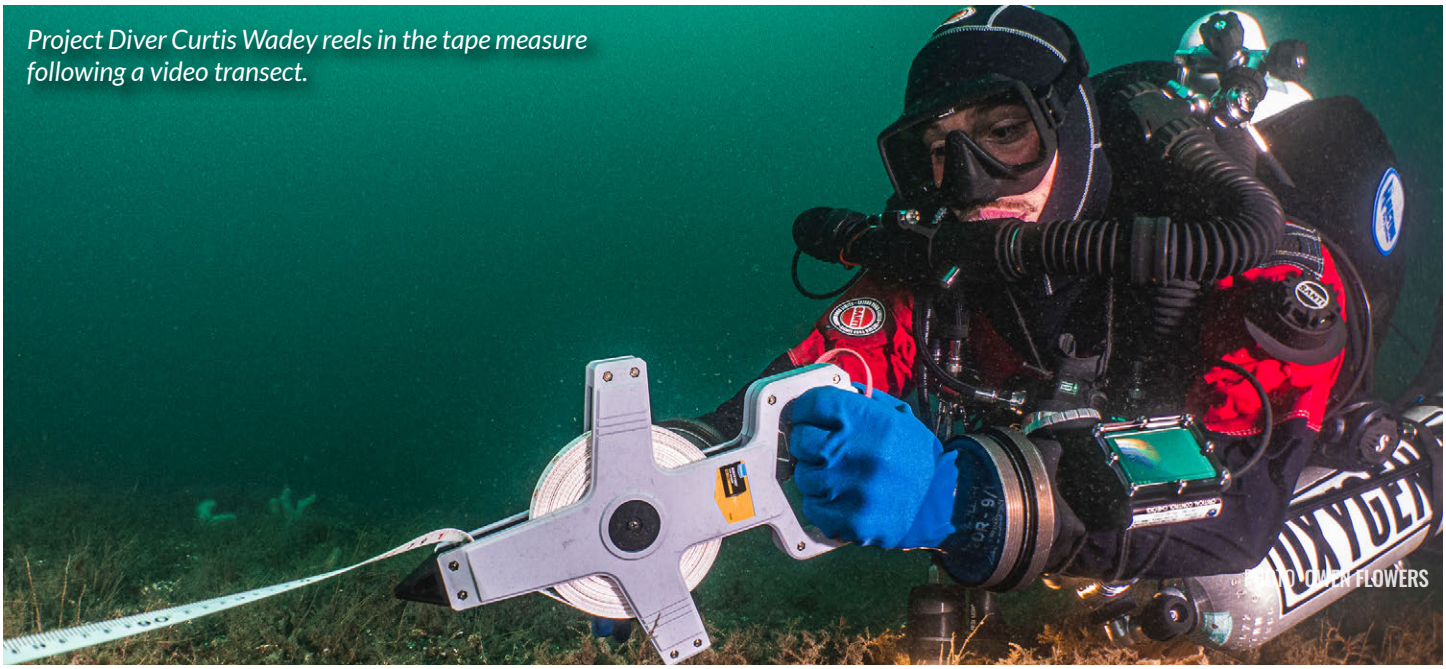
As well as the conservation value of the project, the week was also fantastic for developing the project skills of the divers involved. The dive sites allowed divers who were new to project diving to join more experienced team members, including one diver who brought first-hand experience from the PB Bermuda mission. This proved to be really valuable when developing survey techniques for specific data collection goals.

PBUK and BLUE have already made plans for 2022, with collection efforts being guided by the analysis of last year's data. In 2022, the mission will also be supported on site by MSc research students, to allow more dynamic tasking of the divers. In addition to the collection efforts inside the protected areas, teams will also work outside of them to allow the condition of the seabed to be compared.



*PBUK Trustee and Project Diver Marcus Rose conducting a video transect to capture the benthic species at this survey site.*

PHOTO OWEN FLOWERS




*Project Diver Curtis Wadey reels in the tape measure following a video transect.*

## DIVE TEAM

*Marcus Rose - PBUK Trustee, Owen Flowers - PBUK Trustee, Martin Maple - PBUK Trustee, Alana Dempsey - Project Diver, Stephen Symington - Project Diver, Graham Blackmore - Project Diver, Peter Elwood - Project Diver, Curtis Wadey - Project Diver, Rob Pounds - Project Diver, Rich Walker - Project Diver, Lindsey Scott - Project Diver, Jason Bramwell - Project Diver, Brendan Lund - Project Diver*

## SPONSORS

*Project Baseline, Halcyon Dive Systems, Bardo Creative, Blue Marine Foundation, British Sub-Aqua Jubilee Trust*

## MEDIA LINKS

SS Odense 'the peanut boat' - https://sketchfab.com/models/f88c664c45694f4ab74ffa71d4ed4161

SS Odense reef - https://sketchfab.com/models/76b70a94d98f4dda9225af81b5a848b0

East Neuk - https://sketchfab.com/models/21cd683bdd864221bf7caf11ef2866eb

YouTube video on the Ocean Conservation Trust seagrass restoration project PBUK collaborated with © Marcus Rose and Project Baseline - https://www.youtube.com/watch?v=fpcYFdf_OFs&t=54s

Project Baseline UK website - https://projectbaselineuk.org

Project Baseline UK Facebook Page - https://www.facebook.com/projectbaselineuk

FLORIDA, USA

# PEACOCK 3 CAVE EXPLORATION

FLORIDA

*Peacock 3 basin on a brisk fall morning*

*By Meredith Tanguay*

**LOCATED** in the small town of Luraville in northern Florida, Wes Skiles Peacock Springs State Park is a favorite haunt among cave divers. Peacock 3 is a typically siphoning entrance located partway down the slough from the headspring at Peacock 1 as it heads towards the Suwannee River.

Karst Underwater Research (KUR), under Scientific Research Permit issued by the Florida State Parks Service, has been exploring a lead in the range of 200 ft (60 m) of depth, past extreme restrictions, and has added over 6,000 ft (1800 m) of surveyed line. The project is ongoing.

GUE divers are also working on resurvey and sketching projects in areas of the cave before the restrictions.

## DIVE TEAM

*GUE Divers Meredith Tanguay, Jayme Lustenberg, and Alex Lustenberg participated as part of a team of Karst Underwater Research divers supporting a larger exploration and survey project at this site spearheaded by Adam Hughes, Steve Lambert, and Jefferson Marchand.*

## SPONSORS

*Karst Underwater Research is a 501(c)(3) nonprofit organization and is sponsored by: Divesoft, Fathom Dive Systems, Dive Rite, Golem Gear, Dive Long Intersorb, ScubaForce USA, Stay Dri Scuba, Diver City, and Aqua Vertical.*

# GRUTA DA LAGOA DO JAPONÊS CAVE

## GUE BRAZIL

*By Sergio Rhein Schirato*

IN the first week of November, GUE Brazil divers Sergio Rhein Schirato, Susanne Schumacher Schirato, and Ricardo Constantino organized an expedition to the area known as Jalapão, in the northern part of Brazil. The goal of the expedition was to explore underwater passages associated with the drainage of the Córrego do Sucuri basin, where the Lagoa do Japonês cave is located (S 11° 21' 52", W 47° 33'52"), as described by Cardoso Pereira, et al. (CARACTERIZAÇÃO GEOMORFOLÓGICA DO SISTEMA CÁRSTICO DA GRUTA LAGOA DO JAPONÊS). The dry passages of the cave, as well as some of the partially flooded tunnels, had been previously described and mapped by Grupo Bambuí de Pesquisas Espeleológicas.

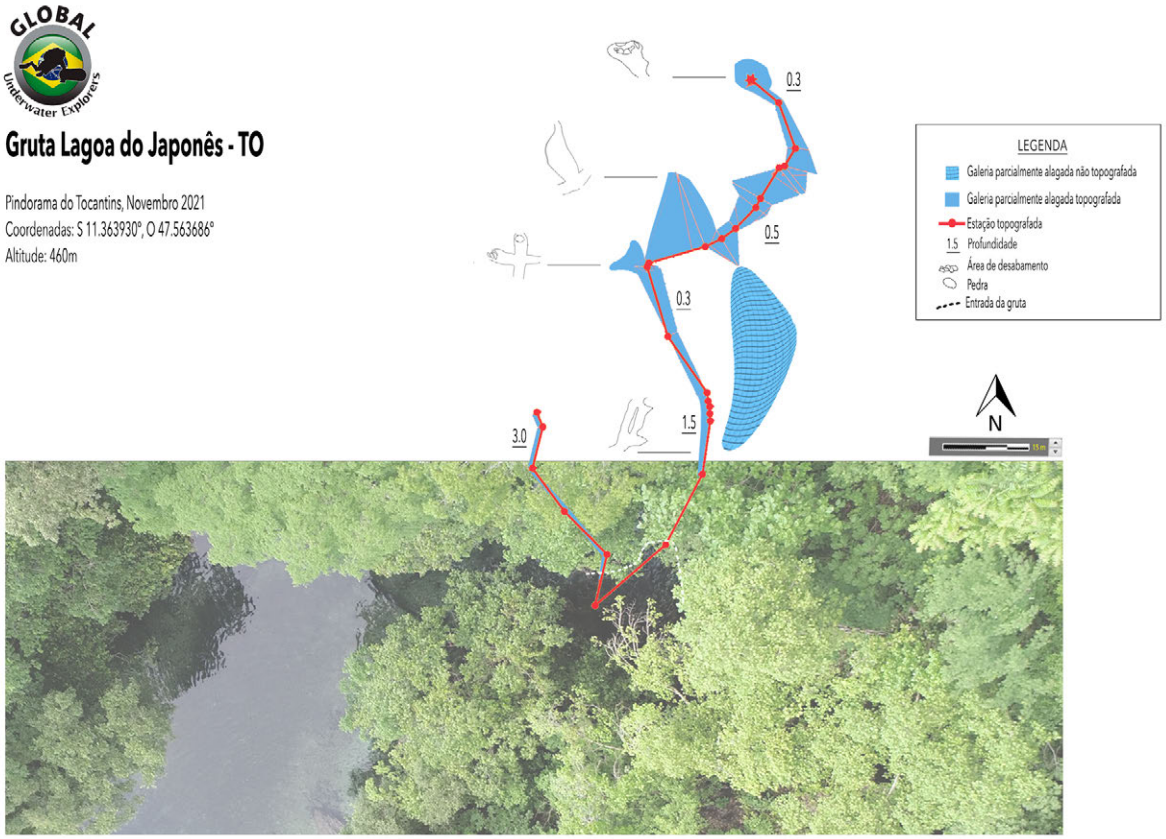
The Jalapão region has an area of 34,000 square kilometres (13,000 sq mi) and covers the municipalities of Lagoa do Tocantins, Lizarda, Santa Tereza do Tocantins, Mateiros, Novo Acordo, Ponte Alta do Tocantins, Pindorama do Tocantins, and São Félix do Tocantins. It has an arid savanna climate with orange sand dunes and rock formations but is crossed by many fast-flowing rivers and streams. Conservation units include the Jalapão State Park, the Nascentes do Rio Parnaíba National Park, the Serra Geral do Tocantins Ecological Station, the Serra da Tabatinga Environmental Protection Area, and the Jalapão Environmental Protection Area. It is in an area of transition between the Amazon rainforest and the Brazilian cerrado, approximately 2,000 km away from the city of Sao Paulo.


*GUE Brasil's portable filling station, a self-reliant unit able to produce GUE standard gases anywhere. Due to the logistical challenges, this is probably the most important piece of equipment during our expeditions in Brazil.*

*An overview of the northern part of the lake, where the cave entrance is located*

During the expedition, the exploration focused on the flooded parts of the cave, searching for underwater passages that would allow for the further penetration. Approximately 300 m/982 ft of passages were explored, out of which approximately 150 m/492 ft were mapped. The cave follows a NE-SW orientation, and many springs, which form the Lagoa do Japonês a hundred meters downstream, are located in the northern area of the cave. During the exploration, the team found what seems to be the largest spring of the system in a newly explored area which is, sadly, in a shallow pool, where further penetration is not possible. Another spring, further to the north, was also found, but in an area which is completely closed due to a collapse of the ceiling.

In comparison to previous results published by Grupo Bambuí, ours did not find substantial




*Map of the dive site that the team is exploring*

differences in the overall morphology of the system, although the orientation of the underwater passages is slightly different than the one published previously. This difference is probably due to the more accurate equipment used during the expedition, especially in flooded tunnels. Additionally, the GUE Brazil team explored approximately 150 m/492 ft of new passages, including a fracture with no noticeable flow, which became too narrow for further exploration after only 50 m/164 ft of new line were placed.

The Gruta da Lagoa do Japonês is an area of incredible scenic beauty. It does not, however, seem to offer more opportunities for underwater exploration unless additional accesses to flooded passages are discovered in the future. On the trip back, the team spotted a spring with crystal clear water that was located just a few kilometers away, which may deserve a visit in the future.

For this project, GUE Brazil team used SUEX scooters, JJ rebreathers, and open-circuit.

*The exploration team. From left to right: Susanne, Ricardo. and Sergio*

Underwater topography was made using Mnemo sensor and Ariane software, and a drone DJI Phantom 4 was used for overall documentation.

## DIVE TEAM

*Sergio Rhein Schirato, Susanne Schumacher Schirato, Ricardo Constantino*

ITALY

# SYRACUSE-THE HEART OF THE MEDITERRANEAN

## TRINACRIA EXPLORERS


THE strategic position of Syracuse in the heart of the Mediterranean, its temperate climate all year, and its large natural harbor, which protects the ships from all winds, have determined 3,000 years of uninterrupted history in which countless dominations have followed one another. These include Greeks, Romans, Byzantines, Arabs, Normans, Aragonese, Catalans, Angevins, Spanish-Habsburgs, up to the Second World War with the Allied Landing in July 1943 in the Husky Operation.

These different dominations have established countless interactions between different peoples and cultures of the whole Mediterranean, determining trade exchanges, new routes, as well as great battles that led to the sinking of many ships and planes.

The objective of TEx (Trinacria Explorers) is, every day of the year, to explore the depths, to discover its secrets, to bear witness to the drama, and when possible, to reconstruct forgotten or still unknown fragments of history that honor the women and the men who made it.

### JUNKERS JU88 + ANCIENT WRECK: HE WHO SEEKS, FINDS!

Two GUE divers, Fabio Portella and Linda Pasolli, found a German bomber type Junkers Ju 88. The search began due to the report of a fisherman who recovered some aluminum parts of the plane with fishing nets. To find the wreck, it took four years of research in an area of about 3 km/1.9 m scoured with DPV at a depth between 58-75 m/190-246 ft.

The wreck is located in front of Ognina port (close to Syracuse) at a distance of 1.5 miles from the coast and at a depth of 64 m/210 ft. The plane appears heavily damaged, and its pieces are scattered within a radius of about 90 m/295 ft. The 2 Jumo-211 engines, a wing, and the tail fletch are still visible and intact. The plane has been identified as Junkers Ju 88 of the Luftwaffe.

This twin-engine bombardier was widely used during the Second World War, and during the Husky Operation, it also was used to bomb Anglo-American ships. The wreck lies right in front of an area where the allied landing took place.

Unfortunately, at the moment, due to the poor conditions of the wreck, the identification of the plane's serial number and the names of the crew have not yet been discovered.

During the Junkers' research, the two divers also came across three ancient amphorae hidden among the rocks at a depth of 60 m/200 ft. By further investigating the site, about twenty more amphorae were found. The last of these were barely visible since they were almost completely covered by benthic formations such as algae, bryozoans, and sponges. All the amphorae have been identified as of the Corinthian type B, probably from the 4th or 5th century BC. In addition to the amphorae, some ancient fishing tools, glazing equipment, and ballast stones from the wreck have been discovered in the area. Fabio and Linda documented the site by taking some pictures, videos, 3D documentation, and by performing an initial division of the area.

In the summer 2022, it is planned to organize some excavation tests in collaboration with GUE divers and the Sicilian Archaeological Department of the Sea.

## DORNIER DO24: THE SEA PLANE THAT SAVED 12,000 CASTAWAYS

GUE instructors Fabio Portella and Stefano Gualtieri found a German seaplane type Dornier Do 24.

The wreck is located in front of Avola city (close to Syracuse), about three miles from the coast and at a depth of 122 m/400 ft. The plane lies in a normal flight position on a mud seabed. The aircraft's cabin cell is raised about 2 m/6.5 ft from the bottom. The tail section is missing, although it is still possible to see the three Bramo-BMW 323R-2 engines, the canopy, and the machine gun. In the bow section the aircraft instrumentation and the two jokes are still clearly visible.

This three-engine and high-wing seaplane was used during the Second World War to search for and rescue aviators who fell overboard. The 6th Seenotstaffeln, a rescue squadron made up of German seaplanes Dornier Do 24 and Heinkel 59, was distressed in the Syracuse seaplane base from March 1941 to May 1943.

Based on the initial historical reconstruction, it has been discovered that two Dornier Do 24 were lost close to Syracuse.

The first was No. 54 CM + IT belonging to the 7th Seenotstaffel, which crashed on 17-12-42 due to an impact with a ship's mast during its take-off. Instead, the wreck found is most likely the Dornier Do 24 W n ° 63 VH + SC, belonging to the 7th Seenotstaffeln, lost on 29-12-42 during a night ditching, probably due to an explosion. In the accident, five aviators died, and one was seriously injured. The name of the Dornier Do 24 W n ° 63 VH + SC aviators are:

Uffz. Heinz Hassler born on 24-1-21

Uffz. Wilhelm Ritzrau born on 9-9-19


*Figure 1: tombstone n. 14 with highlighted the names of the crew of the Dornier Do 24 crashed on 29-12-1942*

Uffz. Ernst Villnow born on 4-2-17

Ogefr. Ernst Jedermann born on 28-10-17

Ogefr. Georg Schweizer born on l 23-6-14

Uffz. Adolf Forster (injured).

The bodies of the five aviators were recovered, and their remains lie under the number 14 tombstone in the German War Cemetery of Motta Sant'Anastasia (Catania).

## HAWKER HURRICANE: THE INSANE PROVOCATEUR!

GUE divers Fabio Portella and Antonio Di Grazia have found an English Hawker Hurricane fighter.

The wreck is located in front of the city of Catania at a distance of less than one mile from the coast and at a depth of 54 m/177 ft. The plane lies in the seabed in a normal flight position, partially covered by sand and fishing nets. The pilot's windshield is broken, and the tail section of the fuselage is missing. The plane has been identified as the RAF's Hawker Hurricane.

This single-engine, single-seat fighter was widely used during the Second World War and it was also used to strafe the Sicilian coasts during the landing of the Anglo-American troops during the Husky Operation.

It is believed that some Hurricanes and Spitfires from Malta performed acrobatics by skimming the runway of Catania airport in mockery at the anti-aircraft post.

Unfortunately, at the moment, the poor conditions of the wreck did not allow the identification of the plane's serial number and the name of the pilot.

## AN ANCIENT WRECK WITNESS OF ANTIQUE COMMERCE

GUE divers Fabio Portella and Linda Pasolli found an ancient wreck carrying amphorae. The wreck is located 30 miles south of Syracuse at a distance of three miles from the coast and at a depth of 70 m/230 ft.

On a muddy seabed, there is a block of about 30 stacked amphorae of the Richborough 527 type, while in their surroundings there are about 20 more amphorae of two other different types. Due to the amphorae position and the type of seabed, it is reasonable to assume that the entire wreck with hundreds of amphorae is present under the muddy layer.

Based on an initial historical reconstruction, it could be hypothesized that this wreck proves the trade exchanges between the Aeolian islands and the cities of eastern Sicily, between the 1st and 4th centuries AD.

Fabio and Linda documented the site by taking photos, videos, 3D documentations, and by performing an initial division of the area.

During the summer of 2022, we plan to organize some excavation tests in collaboration with some GUE divers and the Sicilian Archaeological Department of the Sea.

## NEW SURPRISES FROM AN ANCIENT WRECK

In 2019, GUE Instructors Fabio Portella and Stefano Gualtieri discovered an ancient wreck carrying pots, jugs, bowls, and lids. The wreck is located about two miles from the coast at Syracuse, at a depth of 68 m.

The studies carried out by the Sicilian Archaeological Department (Superintendence) of the Sea highlighted that the wreck can be dated between the 4th and 6th century AD, and the terracotta material could have come from North Africa.

Photo, video, and 3D documentation activities were carried out on the wreck, and an initial mapping of the wreck has been performed.

In 2021, the GUE divers Fabio Portella and Linda Pasolli, during the video documentation activities of the site, discovered a new deposit of terracotta material, in particular some of the bowls found are larger than those located in 2019.

During the summer of 2022 we plan to organize some excavation tests in collaboration with GUE divers and the Sicilian Archaeological Department of the Sea.

# CAVE TRAINING

All GUE cave programs require a combination of GUE training and experience prerequisites prior to commencement of training. Consult with a GUE Instructor or the website for more information.

## CAVE 1

The GUE Cave Level 1 class provides an introduction to diving in an overhead environment. This program bolsters personal skills and awareness. Upon sucessful completion of training, the Cave 1 level program allows divers to go out and enjoy cave diving with their teams.

## CAVE 2

The Cave 2 level program hones in on environmental awareness, increased capacity with extended penetration dives, advanced navigation, use of jump spools, enhanced team awareness, advanced problem resolution, stress management, and use of a stage and/or decompression cylinder.

## DPV CAVE

Reinforce the skills from GUE's DPV 1 course, management of multiple DPVs and all the ramifications of their use, stage cylinders handling, and cave environment-specific applications.

## UW CAVE SURVEY

Gain the competency in basic principles of underwater cave survey; implementation of a defined team approach to underwater survey data collection which prepares an experienced cave diver to productively assist in a coordinated cave project; and an introduction to cartography methods.

## CAVE SIDEMOUNT

The GUE Cave Sidemount provides an opportunity for experienced GUE Cave 2 divers to familiarize themselves with side mount equipment configuration. This course provides an opportunity to experience and explore areas that are too small for the standard GUE backmount configuration.

## CCR CAVE

Venturing deeper into caves and discovering more passages may bring the need for additional time for exploration and redundancy for safety. Being an experienced open water GUE CCR diver and avid GUE cave diver will lead to consideration of using the CCR advantages during cave explorations.

LEARN MORE AT GUE.COM

ITALY

# DISCOVERING HISTORY IN THE MEDITERRANEAN

## SOCIETY FOR THE DOCUMENTATION OF SUBMERGED SITES (SDSS)

*A Carthaginian amphora of the rare T-5.3.1.2 type recovered from the site of Punta Tracino on behalf of the archaeologists*

*By Mario Arena*

THE Society for the Documentation of Submerged Sites (SDSS) is a GUE affiliated, nonprofit organization founded in 1999. Its mission is to support researchers and institutions in archaeological, environmental, biological, and geological underwater investigations and to promote the interest of the general public in the historical and archaeological conservation of the submerged realm. SDSS organizes expeditions, explorations, and documentation projects in collaboration with GUE and other critical research institutions. For over five months during 2020 and 2021, SDSS teams conducted field expeditions in the central Mediterranean Sea, running campaigns on the WWII Battle of Convoys site, the Battle of the Egadi Islands site, and various Pantelleria Island sites.

Both participants and sponsors covered the costs of SDSS activities. These donations contributed vitally to the success of the projects, and in some cases, made them possible. Sponsors also provided special equipment, technical support, and specific expertise to support the projects.

### SDSS SPONSORS:

*SCUBALANDIA Diving Equipments and Distributions*

*SUEX DPVs navigation and advanced underwater electric tools*

*COLTRI compressors*

*DAN Europe*

*HALCYON mfg diving equipment*

*HEALTHY SEAS organization*

*GHOST DIVING organization*

*K01 hoods and gloves*

## BATTLE OF THE EGADI

SDSS's field campaigns in 2020 and 2021 on the site of the Battle of the Egadi Islands of 241 BC resulted in a multitude of important discoveries and significant findings. During both campaigns, a joint team—including RPN Nautical Foundation, the Maritime Archaeology Program team of the University of Malta, and the divers of SDSS—operated on site together under the scientific direction of the Soprintendenza del Mare of Sicily.

The UniMalta team carried out the AUV mounted sidescan sonar survey from onboard RPM's scientific vessel Hercules, covering an area of approximately 20 km2/8 miles2 and providing more than one thousand targets to investigate. The team ordered the targets based on priority—low, medium, or high—and on the probability of their relation to the battle. The investigation of the targets required setting up an ROV dive on each, a long process that occupied the Hercules for weeks of RPM's operation in 2021, and that will be continued in the next campaigns.

The investigations of 2020 and 2021 led to the discovery of four additional warships' bronze rams; a total of 25 have been recovered to date.

But, the team made another exceptional discovery: an ancient merchant wreck carrying a load of several thousands of transportation amphorae. While the artifacts are not related to the Battle of the Egadi, experts identified the amphorae as several different types with a prevalence of the so-called type Almagro 51 Lusitana, dating the wreck to the 4th Century CE. The wreck features two well-preserved iron anchors and will be the subject of further investigation during the 2022 field campaign.

## SDSS 2020 AND 2021 CAMPAIGNS

SDSS's 2020 campaign on the battle site took place for 20 days between July 22 and August 12. During this period, the team conducted 13 days of diving operations for 35 hours of bottom time at an average depth of 80 m/262 ft.

During the 2020 campaign, the SDSS dive team focused on the intensive investigation and survey of a concentrated area of artifacts—named the Professor Line Area, or PLA— located in 2019 during an electromagnetic transect. The SDSS investigation brought about the discovery of numerous artifacts buried under the sea floor's sediment in a 20 x 20 m/66 x 66 ft area, including six helmets, twelve cheek protections, two swords,

*Captured from the model of the Roman wreck of the* Banco dei Pesci


*One of the coins found in Helmet Square. It features the head of Gerone II of Syracuse on one side and a galloping knight with a spear on the other.*

two blades, fifteen Carthaginian bronze coins, and a number of iron concretions and fittile items. The team surveyed and recorded the position of each artifact before recovering it to the surface. Using this data, they created an artifact map of the site.

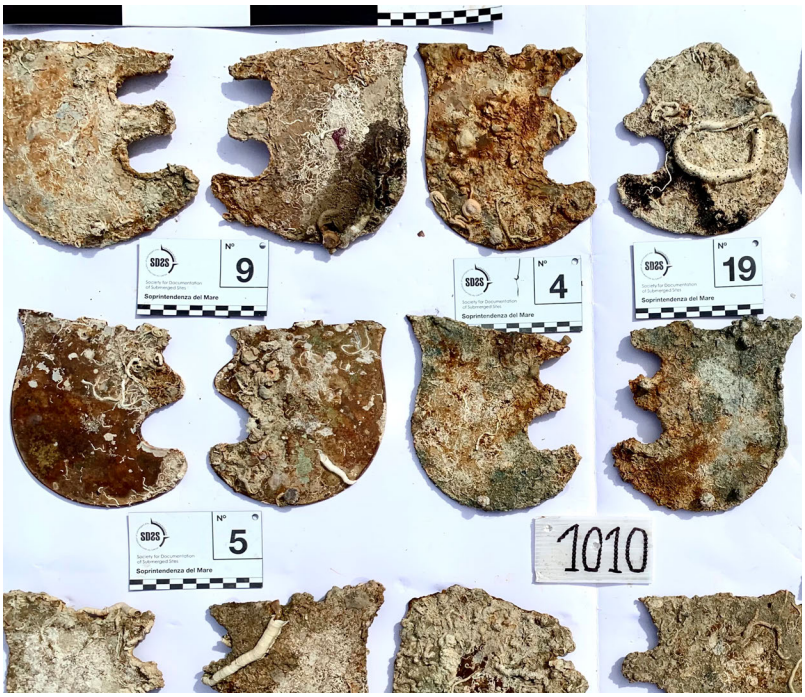
Archaeologists set up an artifact triage facility at the divers' base at the Museum of the Stabilimento Florio of Favignana compound. The laboratory was equipped with containers for the desalination of the artifacts and specialized instruments used to assess each item's composition and monitor its stabilization status.

Besides the work in PLA, divers were tasked with the documentation of an iron anchor found in the battlefield and the excavation and recovery of Ram 17, a process that required two hours of dredge work on the bottom with the special self-contained ROSA/SUEX dredge system. A Guardia di Finanza patrol boat recovered the ram to the surface with a crane on August 2, the birthdate of Professor Sebastiano Tusa, the famed archaeologist who discovered the site and coordinated the project for many years until his tragic death on March 10, 2019.

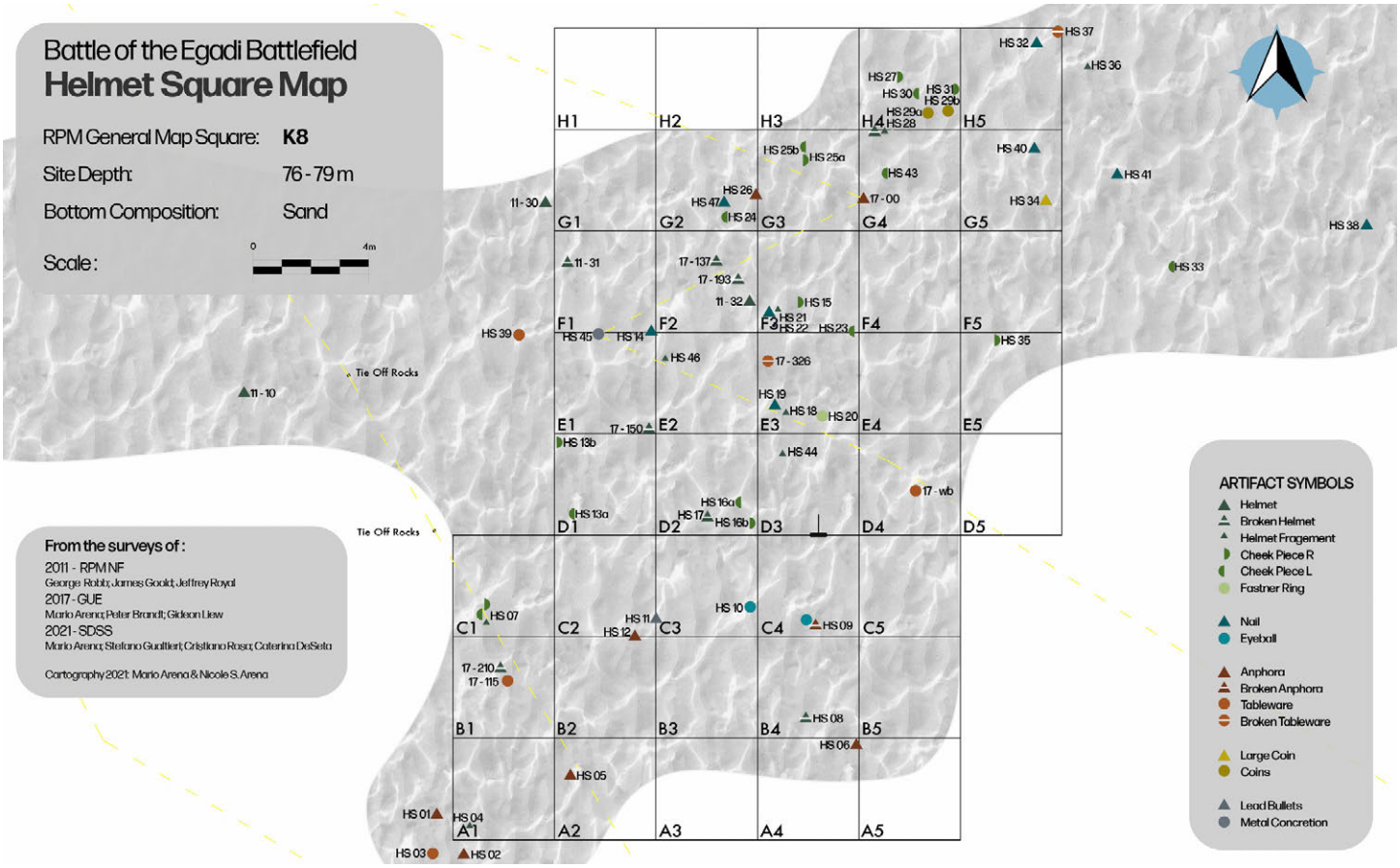
SDSS's 2021 campaign lasted the entire month of August, with 22 days of diving operations.

The diving team's main focus was to investigate another area of concentrated artifacts, dubbed Helmet Square. The area is located 100 m/328 ft Northwest of a cluster of four warship rams, and previous inspections reported several artifacts lying in view on the seafloor. RPM found four bronze helmets in 2011, and GUE located four more helmets and some fittile tableware items during the 2017 campaign.

A test-transect with metal detectors immediately revealed numerous artifacts buried under the sediment in the area. Divers built a survey grid on the sea floor using cave line and iron stakes to create a systematic survey process. The grid measured 32 x 20 m/98 x 66 ft and was divided into 40 sectors of 4 x 4 m/13 x 13 ft each. During the project, the team inspected 25 of the sectors with metal detectors and located a number of items including five helmets, eighteen cheek protectors, one hundred twenty sling lead bullets, thirteen bronze coins (twelve from Syracuse and one from Rome), bronze nails and eyebolts, an iron anchor, amphorae, and tableware




*The collection of cheek pieces recovered in Helmet Square*




items. Divers surveyed the position of each of the items, documenting them on site before their recovery to surface.

After the team completed their work in Helmet Square, divers prepared the four warship rams for surface recovery and inspected the area surrounding each of the rams. A relatively smooth operation, divers only needed to complete one dive for each ram.

During two dedicated working days, in the presence of the authorities and a National Geographic TV crew, the team recovered the four rams and the metal basket containing the items found in Helmet Square to the surface with the help of the Hercules's crane and ROV. All of the artifacts were transported to the Museum of Favignana to undergo the stabilization process.

The final dive of the campaign was dedicated to the photogrammetry of the newly discovered Roman wreck of the Banco dei Pesci, which was accomplished with 2,200 pictures.

The next campaign on the site of the Battle of the Egadi is planned for August-September 2022 and will focus on extending the survey of Helmet Square and performing electromagnetic transects in order to identify other concentrated areas of buried artifacts.

## PARTICIPANTS:

*2020: Mario Arena, Davide Dal Molin, Stefano Gualtieri, Carlo Guidetti, Roberto Picciol, Cristiano Rosa, Giovanni Polizzi, Francesco Spaggiari, Justine Vernier*

*2021: Mario Arena, Caterina De Seta, Stefano Gualtieri, Keith Kreitner, Piero Labò, Cristiano Rosa, Fabio Portella, Giovanni Polizzi, Elke Riedl, Federico De Gado, Matteo Giaretta*

*Vehicles in a cargo hold of SS* Veloce

## BATTLE OF THE MEDITERRANEAN CONVOYS: DOCUMENTATION PROJECT

In the summers of 2020 and of 2021, SDSS conducted two field campaigns for the documentation of the shipwrecks related to the WWII Battle of Mediterranean Convoys. Since 2006, project teams have discovered 41 never-before-dived shipwrecks in the high seas of the central Mediterranean.

The 2020 and 2021 campaign teams established a base on the Island of Lampedusa and set out aboard the Gioel, a fishing vessel owned by the Brischetto brothers, two fishermen based in Lampedusa. Their expertise was crucial to the project, and without them, the team wouldn't have discovered most of the wrecks. The typical diving excursions launched from Lampedusa harbor in the late evening and often required an entire night's journey to reach the designated operation area in the early morning. Depending on the depth of the wrecks, divers performed one or two dives during the day; the boat moved to other targets during the night in preparation for a further day of diving operations before returning to Lampedusa that evening.

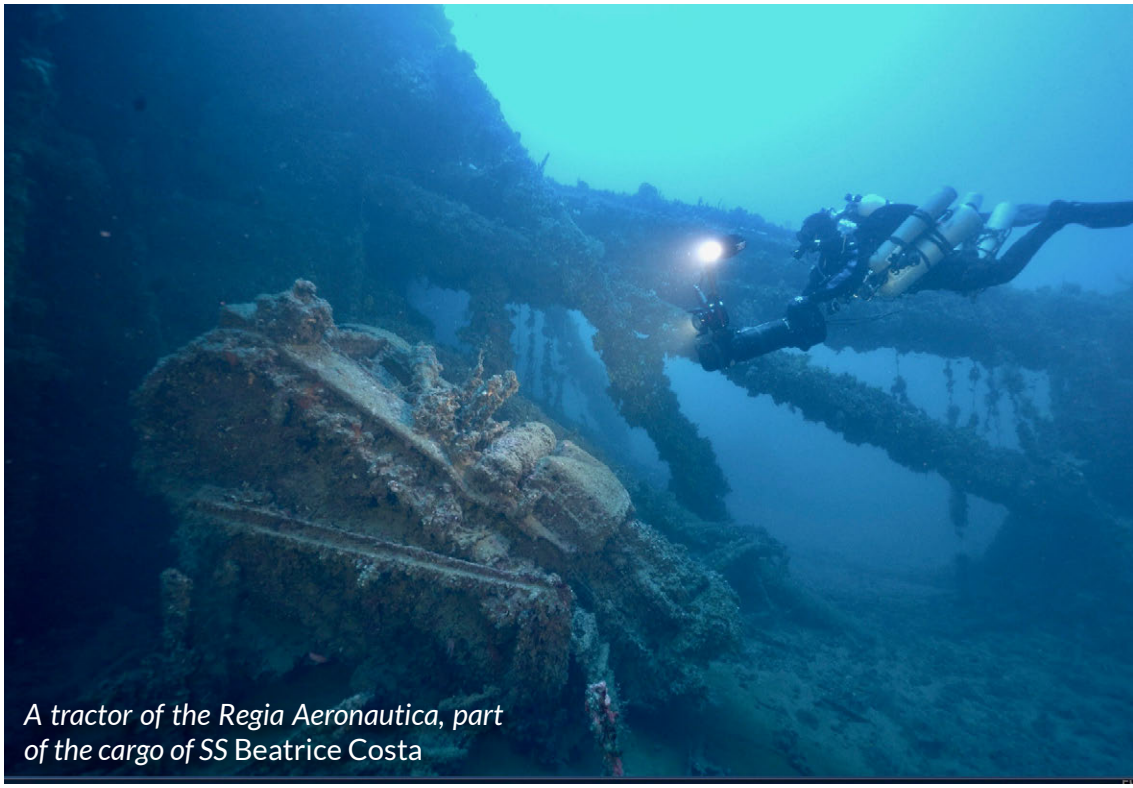
The 2020 campaign lasted 10 days, but due to the adverse weather conditions, the team could only complete two excursions at sea.

The team checked two new wreck positions, both at a depth of 85 m/277 ft in the waters off the Gulf of Hammamet near Tunisia. The first was the wreck of a post-war tugboat with a large A-frame on its stern. The wreck had probably been scuttled on purpose, as all the main instruments had been removed from the bridge and the flybridge.

The second position surprisingly revealed the presence of two wrecks 30 m/100 ft apart; one laid on her left side and the other rested on her keel. The wrecks are spectacular and resemble two MTB or MGBs. On both wrecks, the guns had been removed as well as the instruments on the bridge. Experts analyzed our video documentation during the following winter and identified them as Kondor Class minesweepers/patrol boats built in the Democratic Republic of Germany in the late 60s and in force in the Tunisian Navy since the 90s. They had probably been decommissioned and used as targets, even if some naval records still list them as active Tunisian Navy ships.

Divers inspected a third un-dived position 300 m/984 ft away from the wreck of the Free French submarine *Le Narval*, which was revealed to be the remains of the bow section of the submarine. The wreckage has a length of 15-20 m/50-66 ft and shows the damage from a mine and—most likely—torpedo explosions that caused the survivor-less sinking of the submarine.

One dive was dedicated to documenting the wreck of the SS *Egadi*, the postal ferry servicing the line between some of the main ports of Sicily and the satellite islands of Favignana, Marettimo, Levanzo, Pantelleria, Lampedusa, and Linosa between 1929 and August 1941, when she was sunk by torpedo bombers. During the dive, the team discovered the ship's bell lying on the deck floor in the



*A tractor of the Regia Aeronautica, part of the cargo of SS* Beatrice Costa

bow area of the wreck. During that same dive, the removal of lost nets from the bridge area revealed a spectacular compass binnacle lying on the floor, covered with debris. The team documented both artifacts and their status for evaluation by the archaeologists of the Soprintendenza del Mare.

The team completed one documentation dive on the wreck of the militarized freighter SS *Reichenfelds*, collecting samples of water, sediments, and biota for analysis by the Institute of Toxicology of the University of Kiel in order to assess the presence of toxic chemicals leaking from an unexploded ordnance (UXO). The SS *Reichenfelds* was carrying over 3,000 tons of ammunition destined for the African front and, the next winter, not surprisingly, the Institute's analysis revealed high concentrations of chemicals leaking from the cargo.

The following 2021 summer campaign lasted 30 days, during which the team carried out five excursions for a total of 11 days at sea, visiting and documenting a total of 10 different wrecks. Below is a summary of the wrecks visited and the teams' activities on each one:

### SS *EGADI*

Depth: 78 m/255 ft

The archaeological authorities of Sicily decided to recover the bell and the compass binnacle of the ship, an operation that the team completed successfully. The bell is currently on exhibit in Palermo while the binnacle has yet to be restored. The final destination of both artifacts will be the Museum of Lampedusa Island.

A large section of plastic netting, which was recently lost on the wreck, was recovered from the SS *Egadi* in collaboration with the Ghost Diving and Healthy Seas organizations, who provided expertise as well as technical and financial operation support.

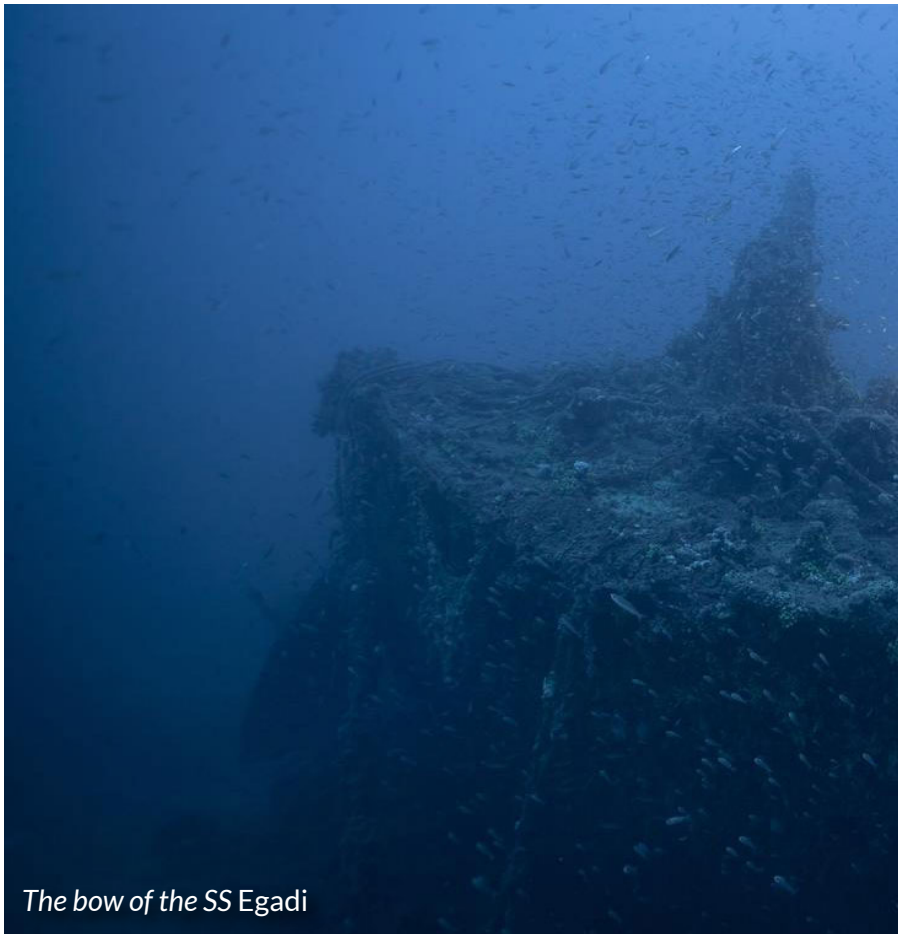
Three teams attempted photogrammetry of the entire wreck of the SS *Egadi*. They shot a total of 6,000 pictures of the ship. An additional dive will be required in order to perfect the results with further photos that will serve to outline some missing spaces in the model.

### SS *BEATRICE COSTA*

Depth: 75 m/246 ft

The impressive, 6,100-ton military freighter—found lying on her right side—was carrying materials for field airports and quarters for the Italian Royal Air Force in North Africa, including two large tank trucks, a tractor, several cars, carts, and fuel in barrels.

The team collected samples of water and sediment from the wreck's surrounding area. During a single dive, two teams of divers documented the wreck with video.



*The bow of the SS* Egadi

### SS *MONTELLO*

Depth: 78 m/256 ft

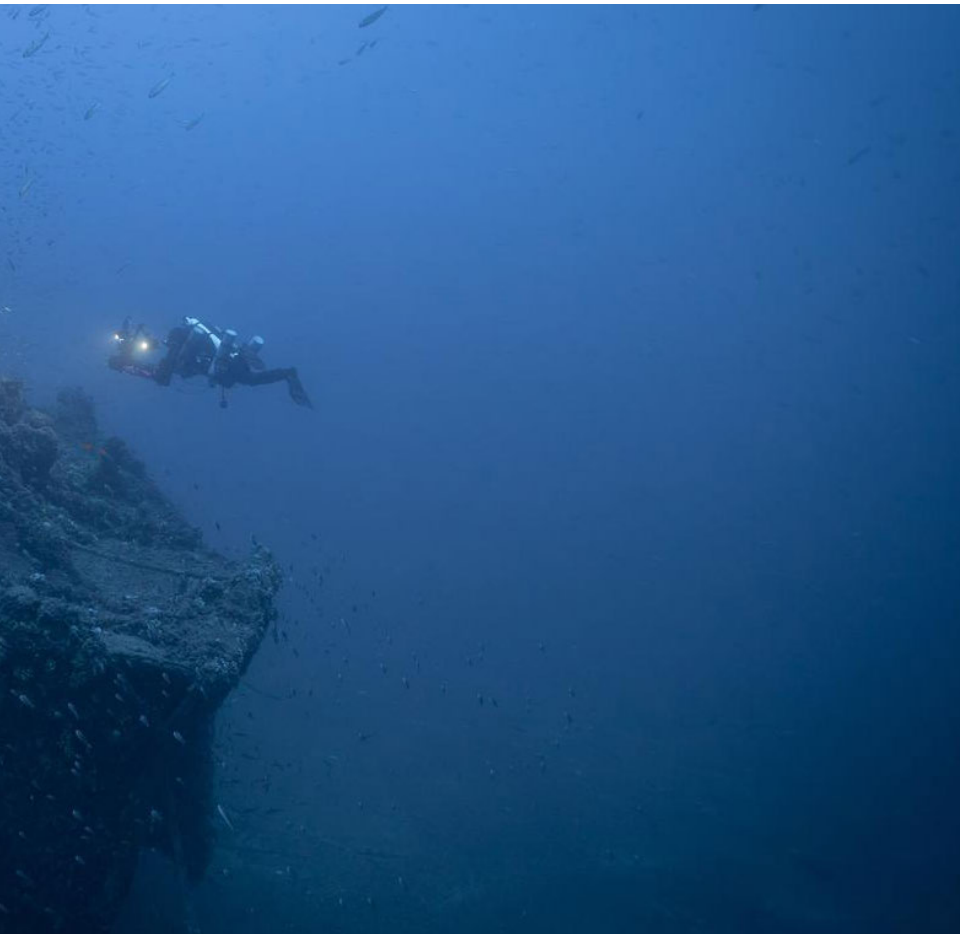
Divers found the 6,100-ton militarized freighter lying upside down in two parts. The freighter exploded after a bomb struck during an air attack while in convoy with the *Beatrice Costa* and other ships. The *Montello* was carrying materials for the 5th Air Command of the Regia Aeronautica, including cars, fuel, ammunition, and two large barges for harbor operations.

Divers collected samples of water and sediment from the surrounding area. During a single dive, two teams of divers documented the wreck with video.

### SS *MARIN SANUDO*

Depth: 75 m/246 ft

A militarized freighter of 5,080 tons, the ship was attacked by a submarine, which hit her left side with three torpedoes, causing her to sink in one minute. Many trucks, carts, artillery, ammunition and other materials are scattered inside and outside of the structures in an intricate tangle of metal



sheets, pieces, and parts that was often difficult to decipher. Since the wreck had been dived before, the team already knew of two Panzer II tanks lying on the bottom, but on this dive, they also identified a Panzer III tank sitting vertically on its rear, an airplane engine, a pile of German helmets, and other fascinating wreckage. The team took samples of water and sediment from the surroundings of the wreck. During a single dive, two teams of divers documented the wreck with video.

### FREE FRENCH SUBMARINE *NARVAL*

Depth: 40 m/131 ft

The team cleaned up several lost nets from the wreck with the help and contribution of Ghost Diving and Healthy Seas. After removing the nets, divers discovered a magnetic compass and an open turret hatch, possibly indicating that the submarine was sailing on the surface—probably at night—when she hit a mine. Divers documented the wreck with a photogrammetry model created from more than 3,000 pictures. Finally, in memory of the 50 young crew members—brave soldiers and officers, most of whom were in their 20s—who perished in her sinking, we honored this Submerged Memorial Site with a commemorative plaque, which was buried in proximity to the wreck. Divers collected samples of water and sediment.

### SS *INGO*

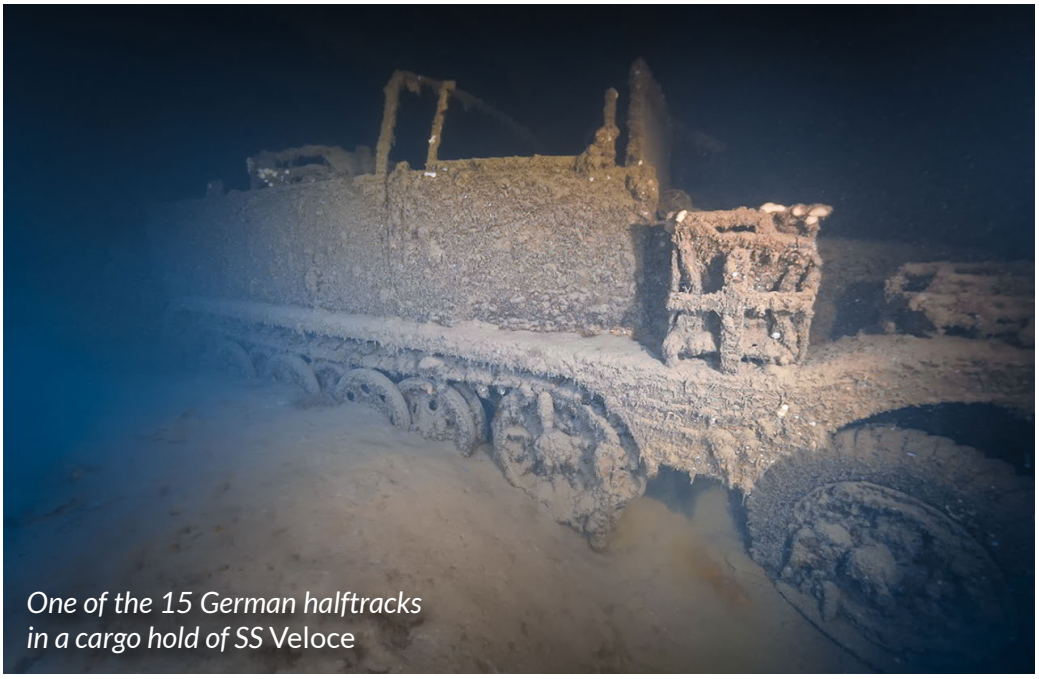
Depth: 60 m/197 ft

This militarized freighter of 3,950 tons lies broken in two parts. The main section includes the bridge to the stern, which is resting on the keel, while the bow section is upside down. A torpedo struck the *Ingo* while she carried supplies for the Luftwaffe in Africa, creating a spectacular wreck. Her cargo includes various vehicles, ammunition, anti-aircraft (AA) guns, and several 6-ton searchlights for AA defenses. The team made an effort to enter under the bow section of the wreck but had to turn back after a few meters of penetration as the environment closed down to barely negotiable restrictions. The team collected samples of water and sediment and documented with video during four team dives.

### UNIDENTIFIED MILITARIZED FREIGHTER

Depth: 60 m/197 ft

Divers found the approximately 3,000-5,000-ton ship on her keel with four cargo holds full of fuel in barrels, artillery ammunitions, bombs for airplanes, German carts for airports, and other vehicles. The ship has a huge hole—5 x 5 m/16 x



*One of the 15 German halftracks in a cargo hold of SS* Veloce

16 ft, probably from a torpedo—on her left side at the height of the engine room, which was devastated by the explosion. Divers took samples of water and sediment from the cargo holds and the wreck's surroundings. Two teams of divers documented the wreck during a single dive. Experts are currently working to identify the ship, comparing the divers' documentation against historical pictures of ships, blueprints; early hypotheses point to the 3,750-ton German steamer *Iserlohn*, which sank on April 21, 1941, during a night attack by surface vessels.

### SS *VELOCE*

Depth: 48 m/157 ft

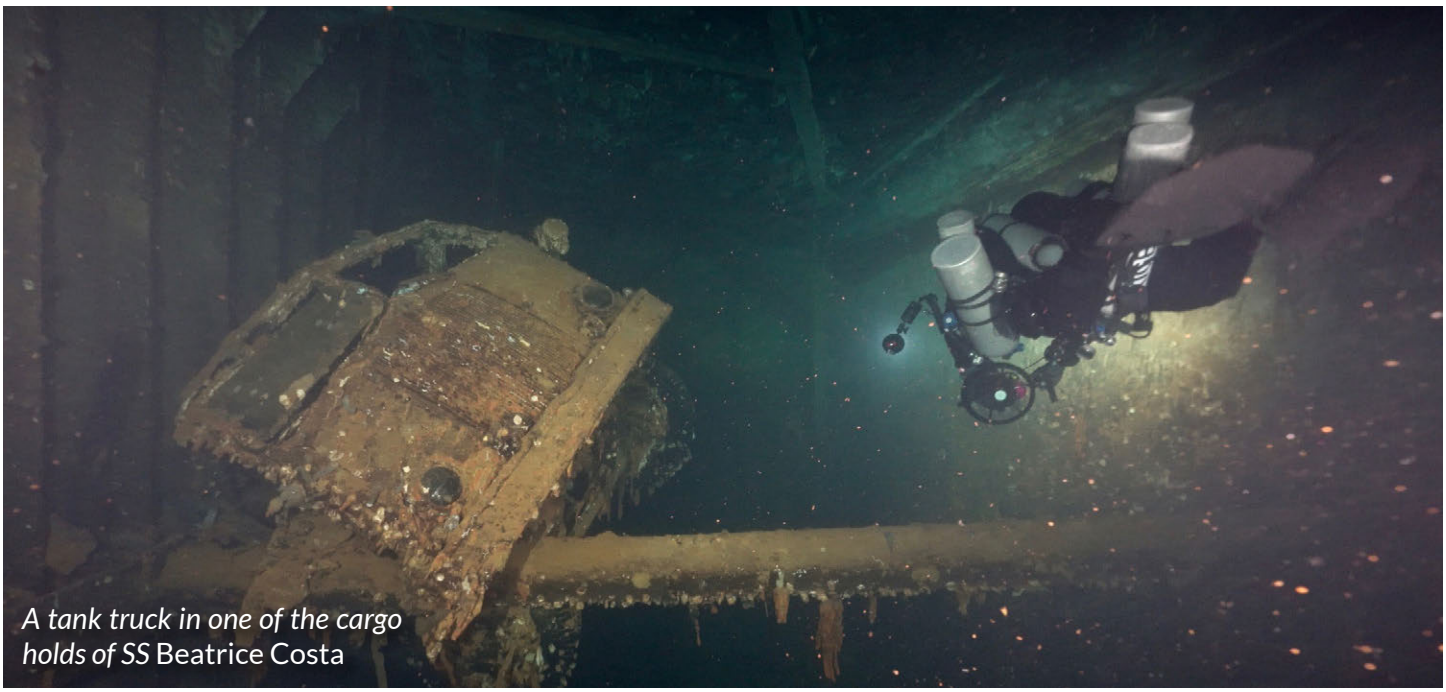
Divers discovered the 5,460-ton militarized freighter lying on her keel with cargo composed of a number of halftracks, vehicles, artillery, fuel in cans, rations, and ammunition. Samples of water and sediment were taken from the cargo holds and the wreck's surroundings. Throughout four team dives, divers documented the wreck with video.

### RN *LUPO*

Depth: 50 m/164 ft

The escort destroyer lies severely damaged on the seafloor. As she was attempting a nighttime rescue of the crew of the SS *Veloce*, four destroyers opened fire on her with 48 120 mm guns and launched torpedoes at her. The wreck is not only damaged from the intense attack that caused her sinking but also by several large fishing nets that cover most of her structures. An effort to clean this Submerged Memorial Site and to honor her crew is planned for next season.

## SIX SHERMAN ARMORED TANKS



*A tank truck in one of the cargo holds of SS* Beatrice Costa

These Sherman tanks were transported by a still-unidentified Landing Craft Tank (LCT) unit that capsized and left the tanks on the bottom. The LCT sank after floating 1.6 km/1 mile and now lies upside down on the seafloor. The six tanks provide a unique ecosystem colonized by large grouper and snapper. Divers documented the site with photogrammetry and collected samples of water and sediments in order to assess the chemical contamination of the area.

*Aerial bombs in one of the cargo holds of the unidentified wreck*

*Part of the team posing with the commemorative plaque posed on the Free French submarine Narval.. The submarine never returned from a war mission in December 1940. It probably sank after hitting a mine and lost its entire crew of 50. Their average age was 22.*

## PARTICIPANTS:

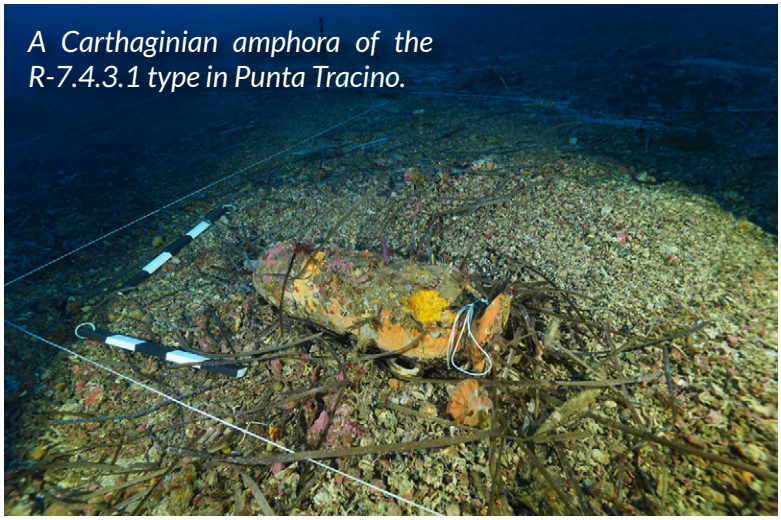
*2020: Mario Arena, Carlo Guidetti, Stefano Gualtieri, Piero Labò, Laura Marroni, Andrea Scaccianoce, Francesco Spaggiari*

*2021: Mario Arena, Federico De Gado, Caterina De Seta, Alberto Ferrandi, Matteo Giaretta, Stefano Gualtieri, Carlo Guidetti, Keith Kreitner, Piero Labò, Henning May, Laura Marroni, Linda Pasolli, Roberto Picciol, Andrea Scaccianoce, Steffen Sholtz, Ivan Wagner, Pascal Van Erp*

*Part of the team posing with the bell of the postal ferry SS* Egadi

## BACK TO PANTELLERIA

Between 2001 and 2011, various explorations located several concentrations of artifacts along the Northern coast of Pantelleria Island. Concentrated in less than a nautical mile, the artifacts lay at depths between 60 and 100 m/196 and 326 ft. Most of the artifacts found date to the First Punic War (264-241 BC) and their concentration in such a restricted area suggests that these remains are related to a minor war event of which we have no historical record.



*A Carthaginian amphora of the R-7.4.3.1 type in Punta Tracino.*

GUE divers found most of the sites during exploration dives, one of which was the subject of a GUE survey project in 2005. Another was discovered during the BaseLine Med Expedition of 2014 using Global Sub's TRITON submersibles, which descended the steep, submerged cliff of Punta Gadir to 250 m/816 ft in search of other artifacts.

In October 2020, a team of SDSS divers under the direction of the Soprintendenza del Mare of Sicily (SDM) ran a two-week archaeological documentation project on two of these sites: the concentrations of Cala Levante and Punta Tracino.

*Cala Tramontana site: A diver documenting a lead stock type Greek-Roman anchor*

The Cala Levante site is characterized by the presence of a number of ancient anchors of different varieties—with a prevalence of the lead stock Greco-Roman type, but also including iron anchors of various ages—some Punic amphorae, and at least six lead ingots. The artifacts are scattered along a spectacular wall, dropping off from 50 m/163 ft to 90 m/294 ft. The divers executed a photogrammetry of the area and surveyed the positions of numerous artifacts.

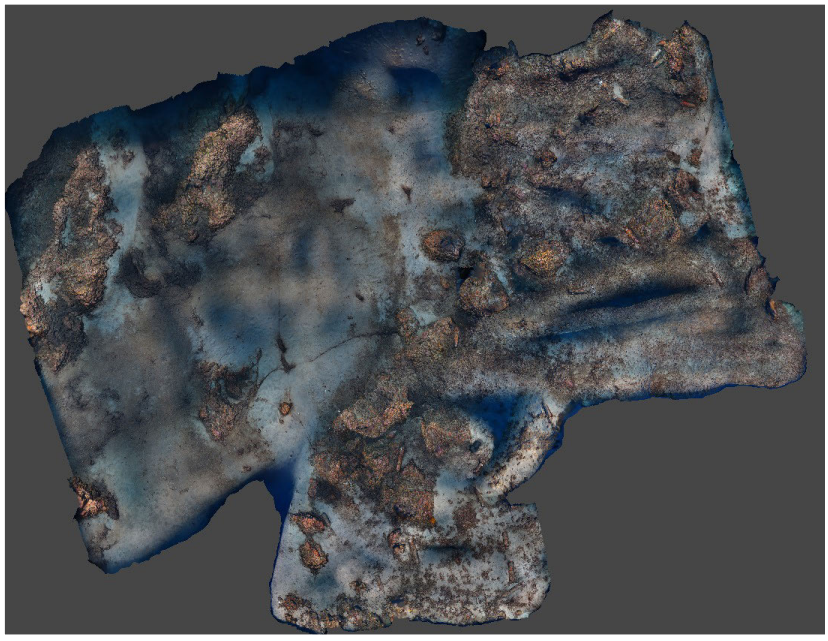
The Punta Tracino site features at least 50 Carthaginian amphorae scattered in an area of 50 x 30 m/164 x 98 ft at the feet of a submerged lava wall at depths between 68 and 85 m/222 to 277 ft. Divers created a survey grid on the whole area and completed a visual and electromagnetic inspection on half of the survey grid sectors. Divers georeferenced part of this site's amphorae using different methodologies such as the SUEX SINAPSI Inertial Navigation System, the BLUE PRINT ARTEMIS LIGHT USBL-based navigation system, and traditional measurements with metric tape and compass. Divers documented the area with a photogrammetry composed of 7,000 pictures. Upon direction of the archaeologists of SDM, the divers recovered several artifacts including two amphorae, one stone ring whose use is still unclear, fifty-eight bronze Carthaginian coins, bronze nails, and several lead rings which were probably part of a ship's sail rig.

The next field campaign for the documentation of these sites is planned for 2022.

*A diver inspecting the sea floor of Punta Tracino with the metal detector*

## PARTICIPANTS:

*Mauro Adami, Mario Arena, Simone Carletti, Marco Colman, Niccolò Crespi, Andrea D'Ambrosi, Federico De Gado, Andrea Farnesi, Alessandro Fenu, Matteo Giaretta, Claudio Provenzani, Massimiliano Sabatini, Romano Rampazzo, Sheila Rinaldi, Elena Romano*



*Top: A screenshot of the photogrammetry of Punta Tracino site. The photogrammetry required over 7,000 pictures of the site.*

*Left: Some of the coins found in Punta Tracino*

# EYEMOUTH

## UK EXPLORATION PROJECT

*By Andy Pilley*

THE United Kingdom Exploration Project (UKEP) has been conducted for the past two years on the south coast of England, with its primary aims and objectives being to locate, document, and identify unknown and undived shipwrecks in the English Channel. After discussion with the project coordinators Neil Powell and Marcus Rose, Andy Pilley offered to plan and organize the first UKEP trip to Scotland.

For those who have not dived in Scotland before, here are a few statistics to provide an idea of what lies on our doorstep. We have 6,160 miles of coastline, and there is thought to be approximately 15,000 shipwrecks in these waters. Scotland has played key roles in two world wars, providing sheltered anchorages for allied warships—the most famous of these being Scapa Flow in Orkney. The east and west coasts of Scotland both saw numerous engagements between merchant convoys and German U-Boats that were seeking to cause havoc and hinder the allied war efforts.

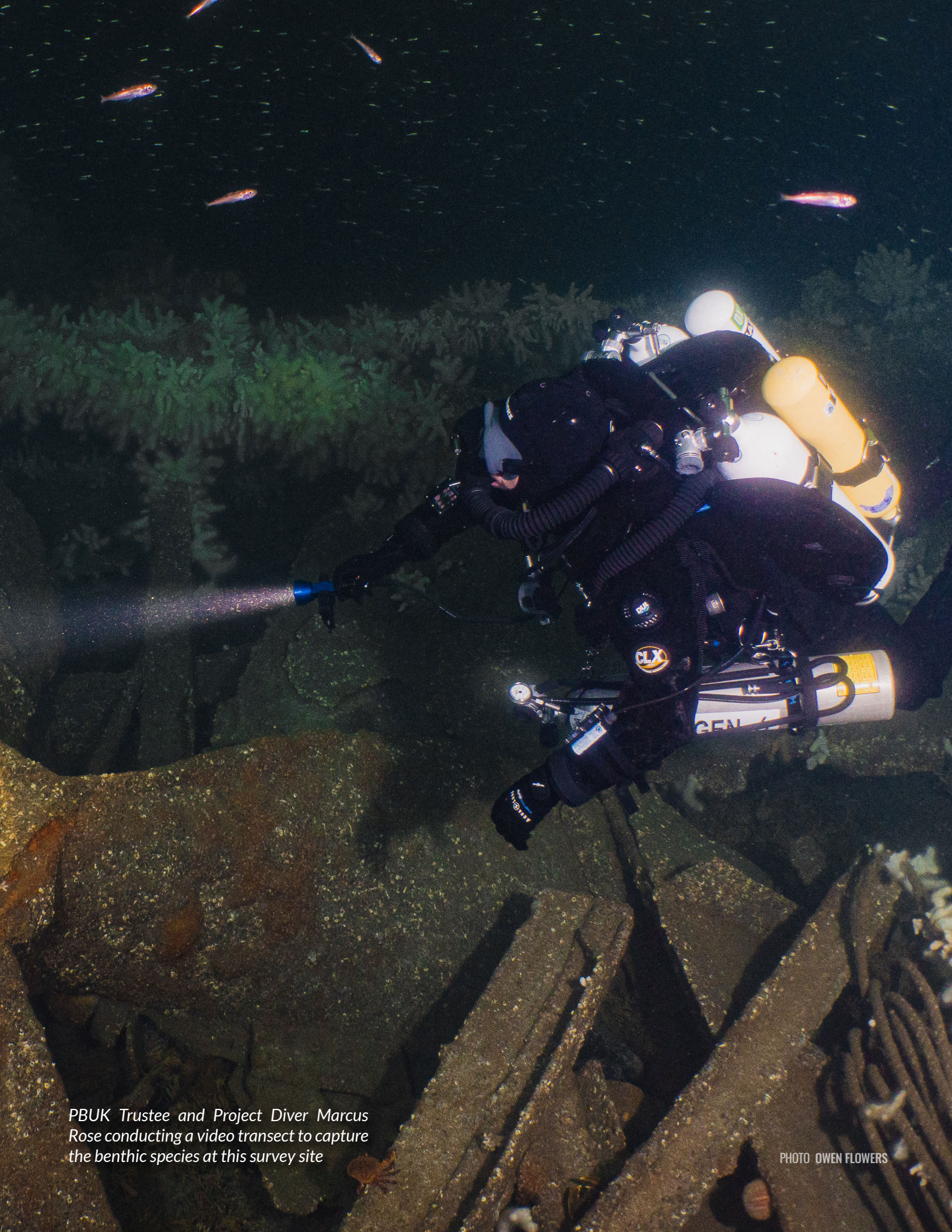
For this project, we chose to base ourselves near the town of Eyemouth on the east coast. Eyemouth is a small fishing town located approximately 43 miles southeast of Edinburgh and five miles north of Scotland and England's border. The town was traditionally a fishing port, and an active fleet still operates from this harbour today. Eyemouth provides access to the North Sea, and there are many both known and unknown wrecks within a few hours from port.

We began preparations by opening a dialogue with Marine Quest, one of the local charter companies that operates from Eyemouth. While there is an existing relationship with Iain (the skipper), we had not undertaken a project of this size at the depth ranges being considered and with several divers that were unknown to him before. This required us to provide more detail on how we would be conducting the dives and what equipment/logistical considerations would be necessary. After a lengthy dialogue, we secured an agreement from Iain, and he provided information on a number of marks, which, to the best of our knowledge, had not been dived before. The information was limited to sidescan sonar images and provided very little detail on the wrecks' identity or the status of their current condition. In keeping with the aims and objectives of UKEP, our goal was to document and, with a little luck, identify these wrecks.

Prior to the first dive of the week, the team gathered to discuss the team roles and responsibilities. We were fortunate to have John Kendall with us on the project, and his objective was to create photogrammetric models of each wreck, to provide a baseline dataset from which to further our research, and to improve our chances of securing a positive identification. The teams were split into two survey teams and one photogrammetry team, using dive propulsion vehicles (DPVs) to navigate around each wreck. The survey teams were assigned to either the bow or stern sections and would gather data from their respective areas.

The first wreck we planned to dive was located 30 miles due east of the town of Arbroath, approximately 3.5 hours to the north of Eyemouth. Having dived in this area before, we knew there were a number of cargo ships sunk by German U-boats in both world wars, and the likelihood was that this wreck would be one of these ships. The sidescan images showed the wreck to be broken into two pieces lying perpendicular to each other, suggesting it met a violent demise.

Upon our arrival at the site, the shotline was dropped at what we believed to be mid-ships, and the first team began their descent to the wreck. The North Sea typically has a layer of plankton



*PBUK Trustee and Project Diver Marcus Rose conducting a video transect to capture the benthic species at this survey site*

PHOTO OWEN FLOWERS

between 6-9 m/20-29 ft, which can add a greenish hue to the water, or substantially reduce visibility, depending upon the time of year. On this occasion, we were fortunate enough to have reasonable visibility through this layer, after which the water cleared and we had at least 20 m/66 ft of visibility in every direction. After tying in the lazyshot (lazyshot is a trapeze suspended under two buoys at 6 m/20 ft that allows divers to decompress as a group and aids in easier recovery to the boat) at 35 m/115 ft, we could begin to see the silhouette of the wreck appearing beneath us as we descended.

Arriving at the wreck, we discovered two large condensing boilers and the piston block located immediately behind. A large debris field was scattered around this section of the wreck with the cargo of coal extending well beyond. The bow was located close to midships and was resting upside down, with elements of the framing showing signs of collapse. After a quick orientation, we headed toward the piston block to begin our search for any identifying marks, but unfortunately a large accumulation of marine life covered all the surfaces, so trying to find a builder's plate proved very difficult. We did manage to identify the steam engine as a "triple expansion type," which suggested that the ship would have been built between 1850 and the early 1900s. The presence of riveted steel plates further confirmed the common construction technique of the time. While these are relatively minor elements to confirm, it all assisted in narrowing down our research parameters.

Moving toward the stern, the wreckage became more twisted and broken up, further suggesting that this unknown ship met a violent end. All of the cargo holds were split open, and the visible pipework was a twisted mess of steel. Luckily, however, we managed to locate the spare propeller lying on the seabed and in surprisingly good condition. We examined the propeller for any identifying marks and took numerous photos for further examination that evening. Anything useful was proving elusive again! Our dive time slipped away faster than we expected, and it soon came time to begin our ascent and ponder over what we had seen during our decompression stops.



Upon return to the boat, we gathered all of the information recorded by the teams and began to assemble what we knew about the wreck. The survey team working on the bow section could not locate anything that looked like the bridge, and we surmised that it was buried underneath the rest of

PHOTO OWEN FLOWERS

*PBUK Trustee and Project Diver Marcus Rose conducting a video transect to capture the benthic species at this survey site*

the superstructure, along with any secrets it may have held. A larger debris field extended away from the bow, and it was agreed that a second dive was needed to thoroughly investigate this. The photogram team began the process of collating the photos and to begin assembling the model, which would take several hours to render. Off the back of this dive, we decided that this wreck needed a second visit on the following day to complete our photogrammetry survey and to begin further investigations.

The second dive was met with similar conditions to the first day. The sea was calm, and we had bright and sunny surface conditions. As per the first dive, the teams returned to their respective areas and began to search for identifying clues. Upon return to the spare prop, we found the remnants of a large enamel hand wash basin, with the original threaded connector and lead pipe still attached. There was no clear manufacturer's mark on the basin; however, the presence of the threaded connector indicated that this was a mass-produced part, further narrowing our construction date toward the latter part of the nineteenth century. We continued on toward the stern in the hope that the ship's name plate might have been visible or lying on the seabed nearby. To our chagrin, we were fresh out of luck again….no identifying marks to be found!

As we began our return to the shot, we took some time to investigate the area around the piston block and boilers again. There was a large debris field, and we believed that there must be a manufacturer's plate on the boilers that we had located. As we began our search, we heard loud shouting coming from the far end of the wreck where the other survey team were working. At this stage, there were no torch signals to suggest anything was wrong, and due to our accumulated bottom time, we needed to begin our ascent.

After meeting the other teams on the lazyshot at 6 m/20 ft, all seemed well and everyone was in a good mood after completing the dive safely. We all returned to the boat and planned to debrief on how the second round of surveys had gone. After getting out of our gear, Curtis, Marcus, and Pete pulled a small and somewhat tarnished bell out of a bucket of water that had been stowed under one of the benches! Of all the things we had hoped to find, we never expected that one of the ship's bells would be recovered on the second dive!


PHOTO OWEN FLOWERS

As per the plan, they had returned to the bow area and began to search the debris field extending beyond this point. After searching for 10–15 minutes and finding only mounds of coal, they decided to return toward the wreck. Swimming three abreast, they approached the bow structure, and Curtis spotted the bell lying partially buried in the silt. After relocating the crab that had taken up residence inside, they attached the bell to a lift bag and sent it up for recovery by the skipper. When they had dug it out of the silt was when we heard them screaming.

Upon closer inspection of the bell, the name engraved on the side was for a ship called the *Wynnstay*, which was constructed in 1884. After the skipper had recovered the bell, a quick search on the archives provided a raft of information to identify the ship and its fate.

The *Wynnstay* was built by Palmers' SB. & Iron Co Limited in Newcastle and was owned at the time of her loss by A/S Harald Grenske. She was renamed the SS *Grenmar* and was a Norwegian steamer of 1438 tons; 873 nrt, 2000 dwt.; and measured 260.4 x 36.4 x 18.0. On 24th March 1917, she was captured by the German U-boat *UC-77* whilst on a voyage from Blyth to Christiania with a cargo of coal. Scuttling charges were placed on the wreck and she was sunk with no casualties to her crew.

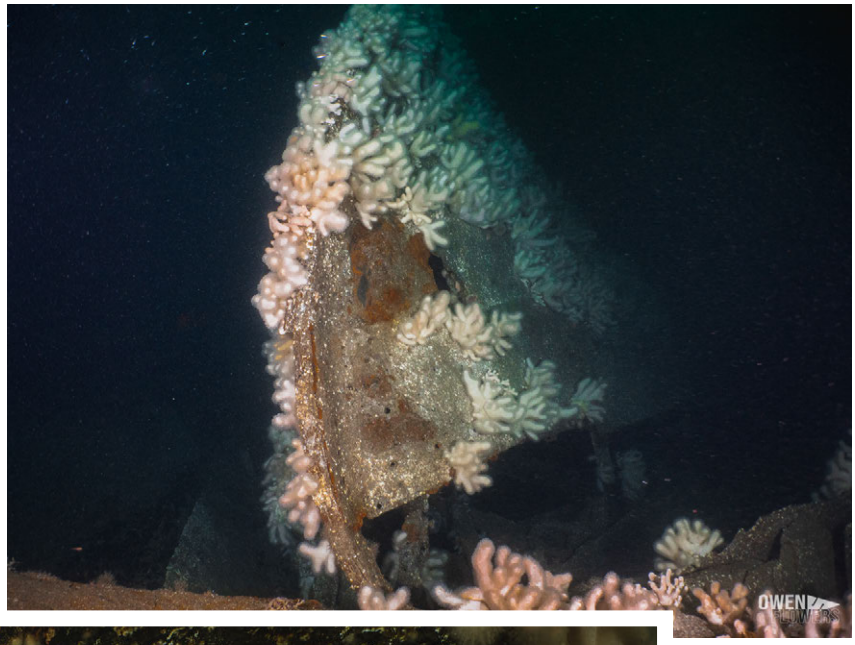
To be able to positively identify this wreck after only two days of diving was incredibly fortunate for the team. In addition to this positive ID, there was another wreck nearby which was previously thought to be the *Grenmar*, but which is now yet to be identified. The team was able to dive this wreck later in the week; however, poor visibility made for challenging survey conditions. It remains for someone to continue the project and hopefully identify this wreck in the future.

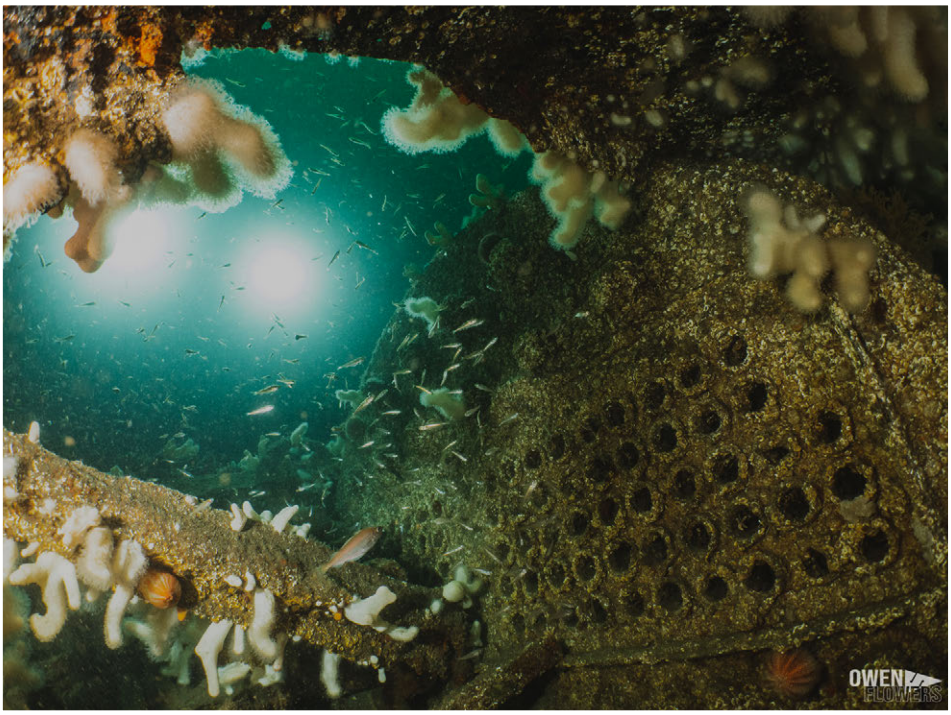
This is only the first instalment of our incredibly successful project week held in Eyemouth over the summer of 2021. We achieved two dives on the *Grenmar*, and single dives on an unidentified/unknown trawler, a suspected to be undived British patrol boat, and other rarely dived wrecks. I

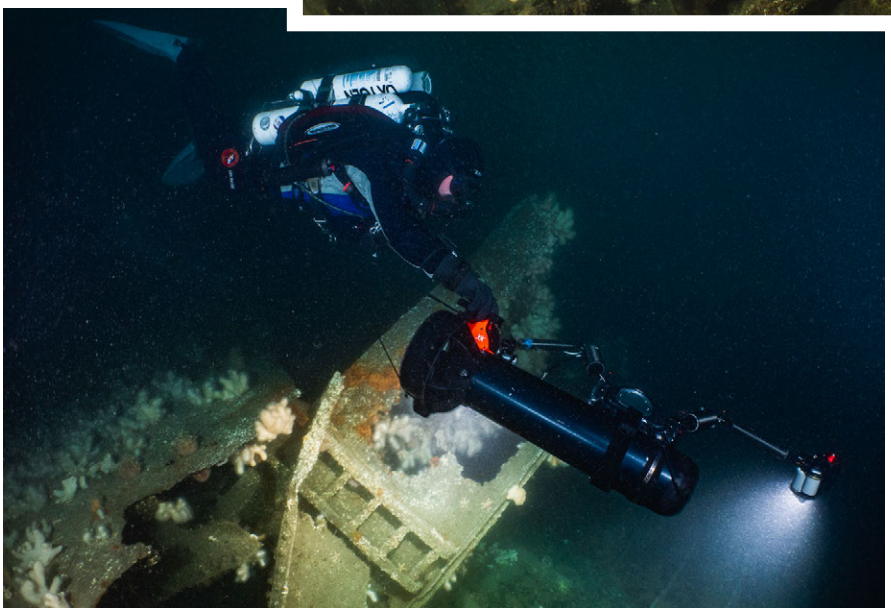
could go into all the details of these, but a much longer article would be needed to document all of these! In conclusion, the positive identification of the *Grenmar* was a fantastic result for the team, and the lessons learned from the project will assist with our future efforts to identify more of the wrecks in the surrounding area.

## PARTICIPANTS:

*Andy Pilley, Marcus Newbold, Owen Flowers, Curtis Wadey, James Sanderson, John Kendall, Rachel Kendall, Matt Worsley, Peter Ellwood*



# CLEANING UP NZ

## GHOST DIVING NEW ZEALAND

*By Edward Howard*
*Photos by Rob Wilson and Vandy Pollard*

GHOST Diving New Zealand (GDNZ) has managed to do several cleanups, as well as other activities that have benefited the environment of New Zealand. As we are Wellington based, most of the cleanups are concentrated in this capital city. But, due to the work we have done in the city, other groups have reached out and asked us to come to all parts of the country. We managed to continue this in 2021 and will be hoping to reach out to more parts of the country in the coming year.

Unlike many other cleanup events, GDNZ cleanups are based on both ocean and shore. We have three main arms to our crew, including the Dive Team who focus on the larger items as well as any other items that they can recover, the Free Dive Team, who are invaluable in their ability to quickly move through the water, collect, and transport items that the dive team have sent up as well as to communicate between the sure team and divers, and the Shore Team, who are the ones to lift and haul the items that the free and dive teams find. They also "de-critter" (go through the rubbish and remove the animals that are trapped), perform outreach to the public, and tackle all other tasks that help events run. Finally, we also have hard working kayaker(s) who enable all the teams to link up and who manage the logistics and provide smooth transportation of all sorts of rubbish from the water to land.

### ANNUAL HARBOR CLEANUP

The annual harbor cleanup has been running for over a decade, with GDNZ taking over the running of the operation several years ago. This event takes place at the Whairepo Lagoon, as it is a central location to the waterfront and used by many groups. As a result of it being a high use area for the public, this can lead to a lot of unwanted debris entering the water. We also find many tires (from cars to heavy machinery) that have been used by boats and buffers on the wharfs. As well as many bikes, electric scooters, cans, bottles, fishing line and equipment, cones, trollies, and all sorts of debris. In 2021 we managed to retrieve over 4 tons of rubbish thanks to our dedicated dive, shore, and free teams. This can be a challenging event as it can quickly become a zero-vis dive once things are being dislodged from the fine harbor mud and sent to the surface.

### POOL TRAINING

As we have a large dive community in Wellington due to the ease of access to the water and a strong culture of water interaction, we realize a lot of the divers that come to our events are not as used to the kind of diving we do for our cleanups (a lot of diving in New Zealand is around the gathering of food/kai moana). GDNZ organizes dive training to give people an opportunity to test new skills such as roping tires, swimming, and carrying road cones and practice doing these with black out masks on. This training opportunity also gives people a safe way to try out the backplate and use a scooter. We include free divers in this training, as they are invaluable in the finding of items and then communicating with shore support since scuba divers often cannot just pop up. Free divers also help scuba divers by coming down and handing/receiving items like lift bags and catch bags.

### ORIENTAL PARADE CLEANUP

Oriental Parade is another very popular part of the waterfront with lots of runners and fishers. As a result, and in combination with the rocky reef and seaweed line, the water around this area is full of discarded and lost fishing line. In the 2021 cleanup we managed to get almost 20 kg of lead from sinkers alone in the discarded line. This also meant that we also found many hooks and hundreds of meters of fishing line. We have cleaned this site three times now over the years, and the local fishing community is very thankful. Several of them have even come along to help the shore Team. This was also when we found a tire from the nose wheel of a plane, which was a large lift and was a good example of why the core dive team and GUE training is essential.

## GDNZ'S GUE GLOBAL CLEANUP

Since we had a section that had been missed from the annual harbor cleanup, we nominated this site for our GDNZ's GUE Global Cleanup. This section of the waterfront is a common place for many visiting Yachats to be moored as well as an egress for the local kayak hire to set up and get their customers in the water. So, we knew this site would turn up some interesting items. One of the items we found was the old display sign from the local kayak hire place that had been blown into the water on a typical Wellington Day. We also recovered a wheelie bin, security fencing, and several road cones and trollies. As this is also a high public flow area, it gave us a great opportunity to show what is going into the waters of the harbor as well as to interact and engage with the public.

## MIRAMAR SEA WALL CLEANUP

The sea wharf, as well as the sea wall, was a site frequented by fishers, but it has been closed now due to safety concerns. The wharf contains an overhang and a snag risk; therefore, our key technical divers are focused on this area, while the other divers are out in the safer areas. We also had a few new free divers who joined us for the first time which demonstrated GDNZ's continuous outreach to build up the team and enhance the skills of the wider group. We recovered a lot of rubbish—the kind that has become all-too-common in our harbor cleanups—cans, cones, bikes, and trollies.

## TRASH FOR TOA TAKE 2 - A BEACH CLEAN IN MEMORY OF LITTLE TOA THE ORCA

This was a beach cleanup and was the result of the local community wanting to do something to help after the unfortunate passing of a baby orca that had been stranded in the rocks after its pod left. It also had to be postponed due to New Zealand going into a lockdown because of the ongoing COVID response. The team assisted with picking up rubbish along Petone Beach.

## GRETA POINT CLEANUP

The cleanup at Greta Point had been postponed due to New Zealand, again, going into a Level 4 lockdown. This ended up being the last GDNZ ocean and shore cleanup we organised in 2021, and we had a great turnout by the public. There were even a few people who happened to be walking past and had no idea what GDNZ was about. They joined the Shore Team after signing up. This location features a long shallow bay, so the retrieval of some of the larger items requires our shore crew to wade into the water to assist the scuba divers and free divers. This location is also next to a historic site, which means to keep an eye out and inform the Dive Team of its location to respect the location.

## INFO EVENING WITH GDNZ

As GDNZ has been running and growing over the past several years in New Zealand, more kiwis are finding out about GDNZ. To reach out to the wider community in Wellington, we had an information evening—a public talk event. Thanks to our friend and long-term GDNZ supporter, Royal Port Nicholson Yacht Club, who hosted us and invited people to join us, we had a wide variety of visitors from both groups, and they had an opportunity to find out more about GDNZ and what we have been doing. We showed the audience some of the cleanup videos and gave them a chance to see the conditions we dive and work in. Not only did we provide a presentation explaining the history of GDNZ, but also showing the gear we use and the animals we find during our cleanups. All of this helped to explain more about us. It was a good evening, and we had a lot of interest from the audience wanting to sign up and help us. We also met with and talked to some divers who had not dived for a while and wanted to get back into it. With Port Nicholson Yacht Club, we also have an ongoing joint project baseline cleanup in their marina, and we have pulled out tons of rubbish from this site alone.

## KARORI STREAM LAND BASED CLEANUP

The last official event of the year was a shore-based cleanup event that was initiated and organized by the Friends of Waipahihi Karori Stream and Mountains to Sea Wellington. Their main focus was to clean up the Karori stream that runs past the sports fields and the school, and they reached out to GDNZ asking for our assistance in the stream cleaning, as they had limited expertise and experience in and around the water. This was a non-dive cleanup and required just drysuits or wetsuits. It was a great cleanup and helped us to continue to grow our connections with other


*Divers work together to remove trash and disgarded fishing gear from the coastlines of New Zealand.*

community organizations and groups. Friends of Waipahihi Karori Stream invited GDNZ to give them a presentation and provide updates in the past to stay connected for any future opportunities to work together.

## OTHER PROJECTS

We have also been involved in what we call our micro cleanups throughout the year. These are specialized and specific cleanups, and retrievals of items that are 1) found in odd locations, 2) not big enough to set up a full event, or 3) specific items we have been asked to find. In the last year, these have been lobster pots that have been lost or discarded, E-Scooters that have been located out of our normal cleanup locations, skateboards, rings, bags, and other items that have been lost by the public.

## FIORDLAND TRIP

This was the third year GDNZ was invited by Pure Salt to be part of their Tamatea BLUE ocean cleanup project in Dusky Sounds. This beautiful, remote, yet well visited location by commercial fishers as well as the tourists, has unfortunately built up a large amount of rubbish income in the bays. There are only a few bays that we can assist, as the area has fiords that go to 500 m/1640 ft and deeper; however, in the areas that we have cleaned, we have pulled out tons of rubbish. The last trip we managed to remove 5 tons of rubbish in a matter of three days. Sadly, among those 5 tons of refuse we found a pile of 50 kg of batteries in one location but they were all recovered. We hope to go back to Dusky Sounds in 2022 to continue working with the Pure Salt team.

## END OF YEAR DINNER

Our long-term volunteers all donate their time and help us to achieve our greater goal, which is to protect our oceans, the fragile environment, and the planet. We had an end-of-year dinner and caught up. We got a chance to say thanks to our dedicated team and volunteers for all the hard work and continuous support with GDNZ.

## PLAN FOR 2022

For the coming year, we plan to get more cleanups done, as well as more talks and other special events to continue with the work we have been


*Some of the items that have been collected by the team are: tires, toliets, bikes, scooters, bottles, motorcycles, and more.*


doing. This will pose some struggles, as we are still in the middle of COVID response, which relies on us being flexible. But as we reflect on 2021, we realize we managed to get several cleanups and other promotional events completed successfully, so we believe we will be able to stay positive this year. In fact, we have kicked off 2022 strong. One pool training was completed and well received (our largest turnout so far for the training session). We also successfully completed our annual Harbour cleanup in February, with a few additional challenges from COVID restrictions and other events happening in the area on the same day.

All in all, we will continue to build and grow as a team of GDNZ as well as to collaborate with other groups around the country for any potential clean-up opportunities around the country.

## TEAM INVOLVED

*The core team of Rob Wilson, Stuart Day, Edward 'Eddie' Howard, Andrew Stewart and Asako Iijima, as well as the extended team of freedivers, scuba divers, and shore crew without whom could not run the events.*

ITALY

# THE ERA OF CONSERVATION DIVING

## PORTOFINO DIVERS

*Conservation divers monitoring red coral populations in the Portofino marine protected area*

*By Bruno Borelli*

IT is not news that GUE divers care about marine conservation, but within GUE there is a small cadre of passionate divers who prefer scientific dives, wildlife monitoring, habitat restoration, and ghost diving over cave and wreck explorations. For these divers, conservation diving has become a real and constantly evolving dive specialty.

To that end, Reef Alert Network (RAN), a non-profit organization, was founded by GUE divers, instructors from a variety of training agencies, and researchers—all of whom strongly believe that the new frontier of recreational diving isn't limited to educating divers to respect the environment. RAN seeks to train dedicated marine conservationists to help scientists monitor and restore the habitats that are most affected by climate change and human activities.

One of the fundamental elements of conservation diving is collaborating with research institutes. Specialized researchers from these institutes provide objectives, diver training, and specific lessons in the internationally standardized, universal language of scientific procedures. Divers and scientists alike facilitate this language through citizen science projects, creating a network of volunteers who study and safeguard the marine environment and collaborate with researchers and park authorities to gather reliable and current data.

For a large group of GUE divers and instructors, 2021 was especially rich in marine conservation projects involving a large group of GUE divers and instructors, coming from many different Italian and Swiss regions, who offered both their support of and participation in citizen science projects promoted by the non-profit organization Reef Check Med and the European program Interreg Mediterranean. In collaboration with park authorities and staff, volunteer training and monitoring dives took place in the heart of the Ligurian Sea's rich waters of Portofino, a marine protected area.

Indeed, one of the most effective methods of mitigating climate change is maintaining marine protected areas, but they are often underfunded or managed ineffectively. In order to develop new management strategies, current information regarding habitat conservation and conditions is needed, and volunteer divers can gather this kind of data via citizen science projects. Thanks to the close collaboration between marine park authorities and divers, aimed conservation and habitat restoration projects in the most endangered areas can respond to the most critical issues.

Volunteer training and habitat monitoring dives mostly took place throughout spring and autumn, when tourism slowed down. Both recreational and technical GUE divers participated in these dives, even though early stage dives were conducted between 5 m/16 ft and 30 m/100 ft.

Thanks to the reliability and competence of GUE volunteers, the divers managed to gather plenty of data that will reveal more about the effects of climate change on marine indicator species in the waters of the endangered areas. The Portofino authority research team processed these data and presented them to the volunteers at the end of November.

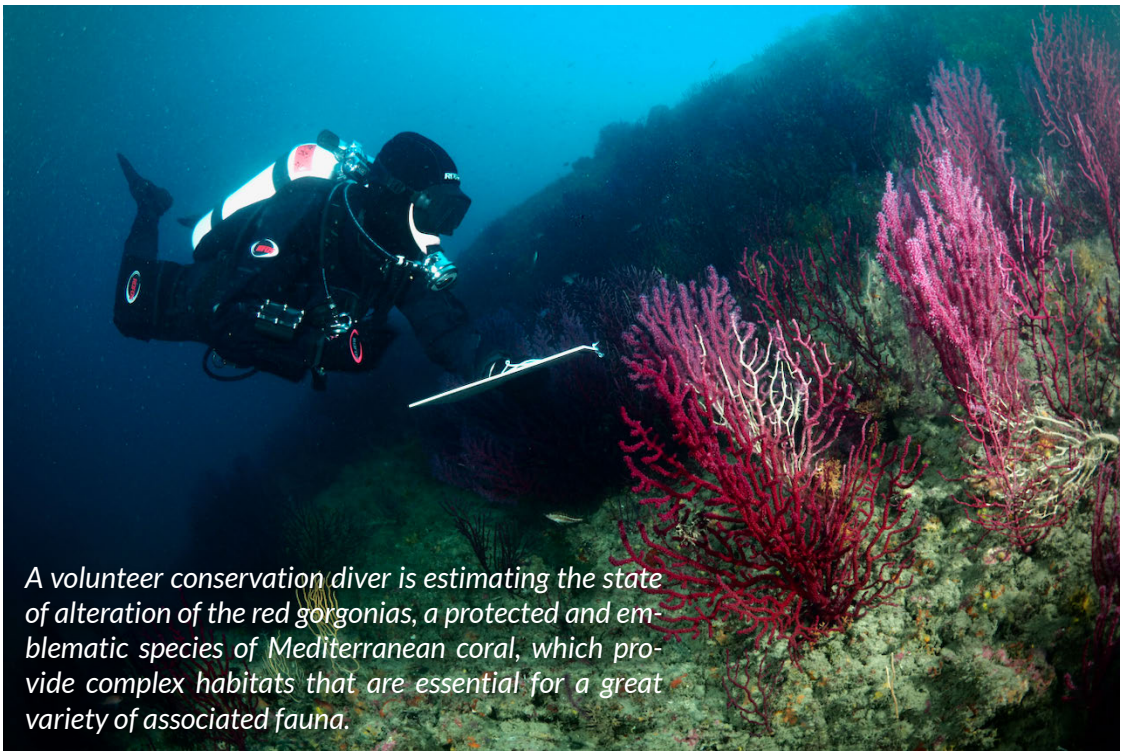
As expected, the news was not reassuring. One of the studies, a Vulnerability Assessment, attempted to predict the future risks in a certain area, both from an ecological as well as a socio-economic point of view. The study found that, without a change in management policy and a reduction of CO2 emissions, the species that characterize the reef habitats of the Portofino Marine Protected Area and their linked ecosystems, will be near extinction by 2050.

From a socio-economic point of view, the study also revealed that climate change's impacts on protected marine areas will affect diving and fishing activities. As could be predicted, fishing activities (through lost fishing gear) were found to be a key contributor to the habitat's increasing vulnerability to climate change effects, but we cannot ignore the added effects of diving and boating activities. The study made clear that more restrictive rules are needed to regulate both recreational and professional fishing, diving, and boating in order to slow down the effects of climate change and extend the pre-extinction timeline.

The studies showcased a third result—the quality of data gathered by the volunteer conservation divers—was comparable to data gathered by

researchers, thus affirming GUE's methods and aims to collect high-quality data.

One of our objectives for next year is to train numerous new volunteer divers who can help safeguard reefs by monitoring the health of indicator species—and the ecosystems—and by gathering data via standardized scientific protocols.



*A volunteer conservation diver is estimating the state of alteration of the red gorgonias, a protected and emblematic species of Mediterranean coral, which provide complex habitats that are essential for a great variety of associated fauna.*

The Reef Alert Network Conservation Diver course aims to provide the basic skills training that divers need to safeguard the marine habitats of the Mediterranean Sea—including collecting data. Furthermore, RAN established a network of contacts and projects to help local dive communities make a difference and reach their conservation objectives.

The Reef Alert Network Conservation Program is perfect for any diver who would like to protect marine ecosystems by providing crucial support to local divers, managing bodies of marine protected areas, and working with conservation-focused marine biologists.

Even simple data collection requires solid diving skills to maintain efficiency and safety. Divers who have passed a GUE fundamentals course are ideal candidates.


*Dott. Luca Merotto of Portofino MPA training volunteers GUE divers on the use of standardized monitoring protocols to assess the effects of climate change in the Mediterranean Sea.*

## DIVE TEAM

*Marco Barollo, Bruno Borelli, Niccolò Crespi, Simone D'Antonio, Martin Demper, Caterina De Seta, Andrea Farnesi, Piero Labò, Susanna Lupino, Ivana Marullo, Nadia Milani, Marica Palazzi, Sheila Rinaldi, Diego Secchi, Marco Selvini, Luca Stretti, Gaia Spaccamonti, Arno Van Dort, Ivan Wagner*

# INTRODUCING GUE LEVEL 3 PROGRAMS

GUE's new Project Diver program distills the agency's decades of project experience into a program that will support the elevation of community-led, project dives to an entirely new level of sophistication.

# EXPLORING THE RIVIERA MAYA

## CINDAQ

*By Sam Meacham, Fred Devos, Christophe Le Maillot, Daniel Ponce Taylor, Julien Fortin*

**RAMPANT** development continues to threaten one of Mexico's largest, most pristine, and culturally significant aquifers. The coast of Mexico's Riviera Maya faces unprecedented growth (even during a continuing global pandemic) that ranks it among the fastest growing regions of the world. Out of sight and mind, the flooded cave systems of the region play a crucial role as the conduits for freshwater transfer from the jungle interior out to the Mesoamerican Barrier Reef. The need to explore and better understand the aquifer of Northern Quintana Roo is important, as it directly influences the health and economic wellbeing of the human population above it and the many ecosystems it nourishes from below. Due to the aquifer's extreme fragility and vulnerability to contamination, the development at the surface poses a significant threat to the economic and social welfare of the region.

Cave diving explorers provide a critical knowledge base by mapping and documenting the subterranean waterways, providing a foundation for scientific work that ultimately can help understand and protect the aquifer and the many ecosystems that it supports.

### OBH RESURVEY AND EXPLORATION

- 56,686 m Resurvey

- 35,060 m New Exploration

- 91,746 m Total Work

- Created a pragmatic mapping method

We continued our efforts to resurvey, document, and explore the Ox Bel Ha cave system. The team resurveyed a total of 57,000 m/35 mi of cave and explored over 35,000 m/22 mi of new cave passageways. Divers improved the integration of the Ariane Cave Mapping software and the GIS database, allowing our team to access updated maps across cell phones, tablets, and computers on the same day as work was completed. Thus, as a team,

*Conservation divers monitoring red coral populations in the Portofino marine protected area*

we could make more informed choices on the next day of diving which, in turn, led to safer, more efficient exploration. We appreciate the effort of

Wetherbee Dorshow of Earth Analytic Inc. and Sebastien Kister of Ariane as we continue to build this platform. We also began to pay more attention to our comments and observations, making special note of the presence of living organisms, charcoal, ocher, and possible prehistoric human activity on our survey data. Over time, and as these observations expand across the cave landscape, they will allow our scientific partners to better understand what we see within the caves and tailor their studies accordingly. Julien Fortin and Andreas Rosland developed a pragmatic method of mapping in order to increase their efficiency and safety while exploring.

Ox Bel Ha continues to amaze us with its beauty, complexity, and obvious importance as a vital link between the jungle environment and the sea. We had the great fortune to observe jaguars on four separate occasions this year while driving on the jungle roads of Ox Bel Ha. We are equally concerned about the future of this magnificent cave as Tulum continues to develop at a tremendous pace.

## THE SIAN KA'AN BIOSPHERE RESERVE

- 2 helicopter flights into the Zona Nucleo

- Forest Fire assessment using drones

- First exploratory dive in Cenote Tuun Ja

Our previous exploration from Cenote Boca Paila, along the coast, hinted at a large system because of the significant size of the cave passage and flow of water coming from a group of very large cenotes 7 km/4 mi to the southwest. In early 2021, we were finally able to launch a three-phased project to access this interesting area. Phase One, in February, included determining whether a helicopter could land in a small clearing close to one of the large cenotes. We succeeded and, upon landing, were able to free dive the cenote and further determine that it was worthwhile to return with dive gear. During Phase Two in October, our team returned with diving gear to confirm that there was, indeed, a significant cave. Ultimately, we discovered that the cave was larger than anything we have seen here in close to 30 years of experience! We were also able to provide reserve stewards with drone assessments of recent forest fire sites in addition to aerial observation and documentation from the helicopter. In 2022, we plan to begin Phase Three, in which we'll establish a basecamp in the area and spend at least 2-3, 7-10 day blocks of time to begin to explore and observe this monster cave. We are all extremely excited about what this area will yield and how we can further demonstrate the value and importance of the Sian Ka'an Biosphere Reserve.

## KANXOC

We returned to the Ejido of Kanxoc in May to follow up our 2020 visit. The main cenote, while large and beautiful, did not have much to offer underwater. Of the two other cenotes, one showed promise, but had dangerously low oxygen levels.

## MICROBE PROJECT

Researchers from University of California, San Diego (UCSD) and San Diego State University (SDSU) designed experiments to be conducted in conjunction with CINDAQ and Universidad Nacional Autónoma de México (UNAM) to collect water samples and measure environmental data from several diverse underwater sites within the Sistema Ox Bel Ha. The first stage of this project entailed collecting pH, temperature, nutrient, and oxygenation of the environment; purification; and 16S sequencing bacteria found at each site, as well as quantitative microscopy of viruses and bacteria (virus to microbe ratio, or VMR). Researchers will phylogenetically store gene sequence data and identify known and previously unknown bacteria.

Final results are still forthcoming, and we anticipate that researchers will publish this research by the end of the first quarter of 2022.

## BIOLOGY

Dr. Fernando Alvarez of the Universidad Nacional Autónoma de México's Instituto de Biología is the leading expert on the fauna of Mexican anchialine caves. With him, we designed a data collection template that includes all of the relevant information he requires for observation and collection of biological samples.

A preliminary study of some samples show the presence of the remipede Xibalbanus tulumensis in cenote Gemini II, the isopod Cirolana yucatana in Cenote Anselmo and a possible undescribed species of polychaete (Annelida) from Cenote Gemini II. The latter is of interest since this organism was captured in freshwater. Normally, the species in that group are marine. All these records and others to be examined in the coming months represent, in any case, the southernmost occurrences of these species along the coast of the Mexican Caribbean. CINDAQ also collected photographic and video records of what seem to be new species in two more invertebrate groups.

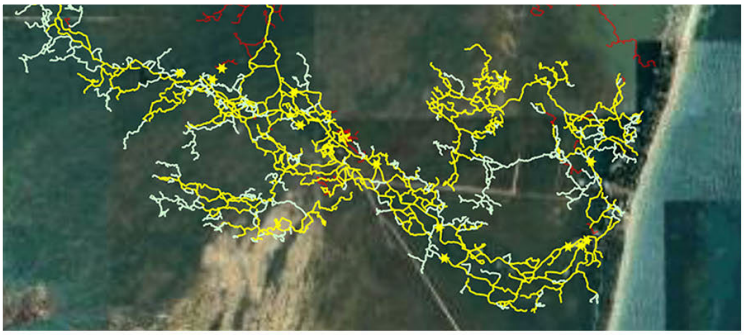
## REAL-TIME CAVE MONITORING

Whereas exploration, survey and mapping allow us to take a snapshot of the physical features of the cave at a given point in time, installing sensors in the cave to measure flow, temperature, salinity, water level or any other information and building an architecture to access that data instantaneously would potentially open new fields of investigation for our scientific partners and reveal previously unnoticed patterns throughout the cave systems. Dr. Richard Wylde, has put his wealth of scientific knowledge and experience into the drafting of a concept to implement this idea.

## SCIENCE PROJECT

After a hiatus due to the pandemic, it was great to be able to continue with the usual twice-yearly Science Project hosted by CINDAQ the Mexico Cave Exploration Project (MCEP) from Nov. 30 - Dec. 4, 2021.

Dr. Eduard Reinhardt celebrated his 15th year studying the aquifer and cave environment of Quintana Roo, Mexico. Over these years he has pioneered the understanding and historical recreation of the area's aquifer. Apart from the usual microfossil sediment and algae work, this latest project allowed time to experiment with new tools and methods of sample collection to better understand the intricacies of the area's karst environment. Although his students at McMaster University in Hamilton, Ontario, Canada,were not able to travel for field work, they will play an important role in further lab work and in analyzing the data collected.



TMLU Survey Data from Ariane

```
    currentdate_string = currentdate.strftime('%Y-%m-%d') #Convert the current date to a string
    currentdate_regexp = '<DT>'+currentdate_string+'<\/DT>' if currentdate_string != '' else '' #Part of the regexp dealing with date

    #if comment_regexp == '':
    #    currentdate_regexp += '<CM>(.[^<][0,'+max_field_length+'])<\/CM>' #If no comment is specified, add a placeholder for all comments

    if explorer_regexp == '':
        currentdate_regexp += '<EX>(.[^<][0,'+max_field_length+'])<\/EX>' #If no explorer is specified, add a placeholder for all explorers

    date_available=re.findall(r''+currentdate_regexp,text, flags=re.DOTALL) #Check if there is data for the current date (accelerates subsequent data
    if date_available : #If any data available for that day, search and calculate
        regexp_string = color_regexp+comment_regexp+currentdate_regexp+explorer_regexp+'<LG>([0-9]+\.[0-9]+)<\/LG>' #Build the regexp with the needed
        #print(regexp_string) #Print each RegExp
        all_lengths=re.findall(r''+regexp_string,text, flags=re.DOTALL) #Build a list of all relevant shots
        #print(all_lengths[0]) #Print all data for the current date
        day_length_sum = 0 #Reset the daily counter
        for eachlength in all_lengths:
            #print(eachlength[3]) #Print each length
            day_length_sum += float(eachlength[length_pos]) #Adding the current section length to the current day
        if verbose ==1:
            print(str(round(day_length_sum,2)) + ' m ' + activity + ' on ' + currentdate_string)
        total_length_sum += day_length_sum #Adding the line length of the current day to the total

    currentdate += datedelta #Move to next day if there is a next day

return total_length_sum
```

Python Analysis Script

It was also a pleasure to assist in the continuing studies of Dr Ioannis Rekleitis and his students from the University of South Carolina and his underwater robotics research. Along with Dr. Alberto Quattrini Li, his students from Dartmouth College joined efforts and collected data to investigate several methodologies:

First, the utilization of a single action camera (GoPro 9) for tracking the trajectory of the camera in conjunction with a sparse representation of the environment. Then, from the data collected, they will examine the effect of percolation during loop-closure operations. In addition, data was collected utilizing a sensor suite that contained stereo cameras, IMU, water depth sensor, and a pencil beam scanning sonar. It is expected that the stereo camera, in conjunction with the sonar sensor, will provide more accurate results than from a single camera.

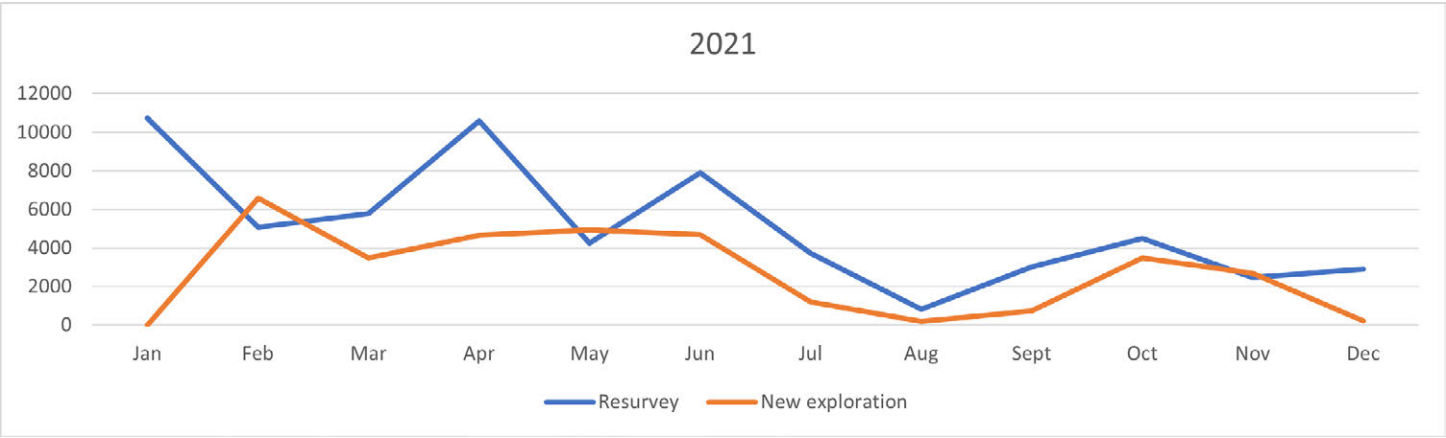
In addition, a custom-made autonomous underwater vehicle constructed at Dartmouth College was deployed in the open water area of the Cenotes and also inside the caves for two main goals. First, to collect data inside the cave using a camera, an IMU, a water depth sensor, a multi-beam sonar, and controllable dive lights, with the robot carried by a diver. This was the first time such a collection of sensors was deployed. The data would be used to understand the utility of a multi-beam sonar in detecting obstacles and open spaces, as well as for 3D reconstruction. Second, to test some primitive autonomous behaviors. The Dartmouth robot was deployed inside the cave and performed preprogrammed motions autonomously. During these motions, sensor data was also collected which will allow the team to better design the full autonomy of the robot.

Special thanks to the 22 volunteer GUE divers from eight countries who dedicated their time and abilities to facilitate these important studies.

## UNESCO ACCREDITATION

We are very proud to announce that in June of 2021 our application to become an accredited NGO for the 2001 UNESCO Convention on Underwater Cultural Heritage was accepted. The accreditation recognizes our commitment to following the best practices outlined in the convention to study and protect underwater archeology.

For more information on the convention please follow this link.



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*** DATA FILTERED FOR SurveyFolder\.DS_Store.
*** FILTERING DATA FOR SurveyFolder\Chan Ayim_survey.tmlu...
*** DATA FILTERED FOR SurveyFolder\Chan Ayim_survey.tmlu.
*** FILTERING DATA FOR SurveyFolder\Koox Baal.tmlu...
*** DATA FILTERED FOR SurveyFolder\Koox Baal.tmlu.
*** FILTERING DATA FOR SurveyFolder\naharon_upstream.tmlu...
*** DATA FILTERED FOR SurveyFolder\naharon_upstream.tmlu.
*** FILTERING DATA FOR SurveyFolder\OBH-Complete.tmlu...
*** DATA FILTERED FOR SurveyFolder\OBH-Complete.tmlu.
*** FILTERING DATA FOR SurveyFolder\shoam.tmlu...
*** DATA FILTERED FOR SurveyFolder\shoam.tmlu.
*** COMPILING LENGTHS...
61766.3 m Resurvey from 2021-01-01 to 2021-12-28 (Explorer(s): All)
35311.4 m New Exploration from 2021-01-01 to 2021-12-28 (Explorer(s): All)
97077.7 m Total Work from 2021-01-01 to 2021-12-28 (Explorer(s): All)
*** COUNTING COMMENTS...
11 comments containing Charcoal during Resurvey from 2021-01-01 to 2021-12-28 (Explorer(s): All)
3 comments containing Charcoal during New Exploration from 2021-01-01 to 2021-12-28 (Explorer(s): A
14 comments containing Charcoal from 2021-01-01 to 2021-12-28 (Explorer(s): All)
```

Report Output

## DATA MANAGEMENT AND USE

- 15.26 Tb, 540,335 files, 27,551 folders
- 350,000 pictures & 16,500 videos
- Over 20,000 pictures tagged and searchable
- 3 copies of all CINDAQ data: NAS, online backup, offline backup
- 4 ways of accessing the data: Web-based, LAN-based, FTP, DropBox

Over the past 25 years, CINDAQ has collected a wealth of data pertaining to all aspects of the aquifer, the bioregion, and the local communities.

While the value of the collected data is undeniable, the CINDAQ team became increasingly aware of the need for a solid system to store, sort, access, and share the available information.

With our data management system now solidly in place, we can begin to integrate the information stored in it with our GIS infrastructure. As we begin to develop and expand on this, we will be able to help scientists not only visualize the spatial distribution of our data specific to their field of study, but to also query and quickly reference it.

While a geo-located file structure has proven very useful, we also started utilizing more advanced tools to mine data out of these files. We can now extract information allowing us to monitor exploration progress by cave system, team member, time period, or to parse all survey comments to try and identify patterns in the cave.

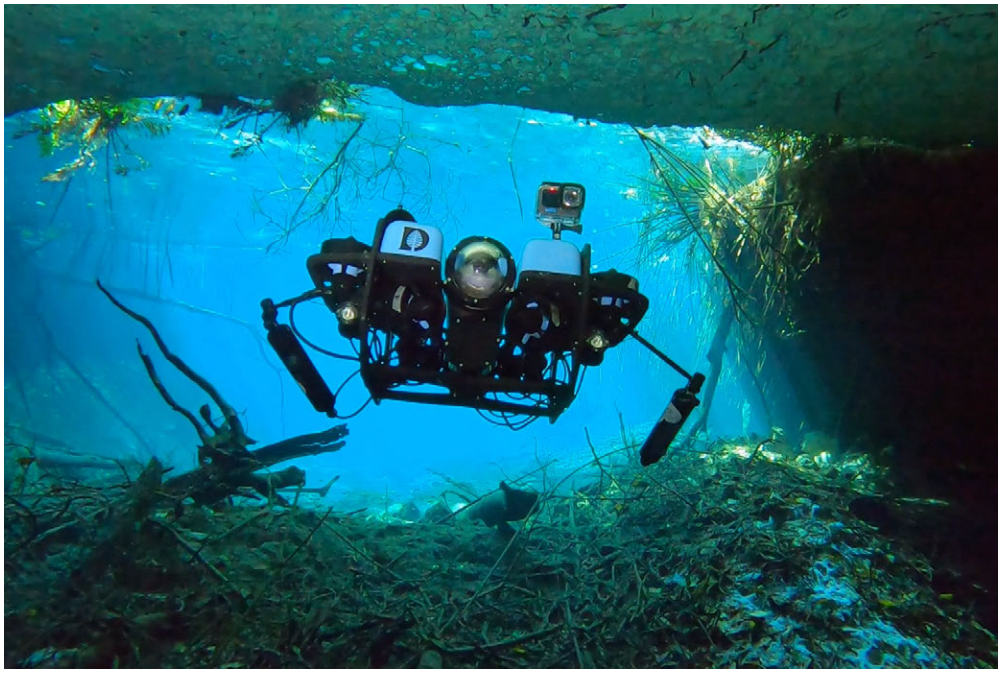
Furthermore, the data can be split into time intervals for further analysis.

## MEETINGS & PARTNERSHIPS

- Member of Municipal Watershed Committees
- New Partnerships signed with local organizations
- Attended Sustainable and Social Summit
- Attended sessions for the Ecology Commision and the Tourism and Ecology Commission, Solidaridad
- Attended sessions for Agenda Tulum

Although most of us would prefer to just go diving, meetings and partnerships can shape the value of our time spent underwater. Our expertise can provide scientific and technical advice to the municipalities and elected representatives who should then take the provided documentation and conclusions and transform them into municipal and local regulations.

This year we have maintained and established new partnerships with parallel organizations including Centinelas del Agua , Cenoteando/UNAM Sisal, UCSD/QUALCOMM, UNAM, Comisión Nacional de Área Naturales Protegidas (CONANP).



## FOOTAGE

The information and imagery surrounding what we do can be a very useful tool in generating awareness and understanding. We are continually improving our video abilities both underwater and at the surface. We were able to capture images in a range of local cave environments, in addition to a significant amount of underwater and topside B-roll that was captured to accompany the wealth of interview footage we collected throughout the year.

A selection of underwater clips can be accessed through the following links:

www.cindaq.org/halocline

www.cindaq.org/sagitario

www.cindaq.org/icepalace

## CENOTE BASELINES

During the summer, an experimental project of field recording the audio of cenotes was begun. The ambient sound near a cenote will surely change as development encroaches and these stereo recordings will act as a baseline for future comparison. These recordings form part of a larger plan to systematically document the present state of cenotes through both hard data as well as capturing the aesthetics of these cave openings.

## THE VALUE OF GUE

Apart from the tangible work accomplished and the enjoyment we have diving in the cave environment, this year of exploration, research and documentation further confirms the value, of collaboration between scientific objectives and the abilities of GUE trained divers. And for individual scientists looking to further their underwater capabilities, these projects make clear how pursuing a path in GUE training can greatly expand their research possibilities.

## ACKNOWLEDGEMENTS & THANKS

CINDAQ and MCEP are grateful for the support we received in 2021 from:

*Dr. Robert Lourie*
*Mr. Rami Shakarchi*
*Joyce and Lester Coleman*
*Mayakoba Golf Classic - Tequila Patron*
*Mr. Joe Mazzeo*
*The Strauss Family Foundation*
*Mr. Brian Strauss*
*Mr. Rick Guerin*
*Mr. Michael Ortiz*
*DroneDeploy*
*Zero Gravity Dive Center*
*Halcyon MFG*
*SUEX*
*Reef Photo and Video*
*Jeremias Hernandez*
*Jose Luis Hernandez*
*Olinka Cortes*
*The Friends of Mexican Development Foundation*
*Quintana Roo State Government*
*The Honorable Alfredo Arellano Guillermo - Secretary of Ecology and the Environment*
*INAH SAS*
*Dr. Roberto Junco Sanchez*
*Dr. Silvina Vigliani*
*INAH Yucatan*
*Arq. Helena Barba-Meinecke*
*INAH Quintana Roo*
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*Earth Analytic Inc*
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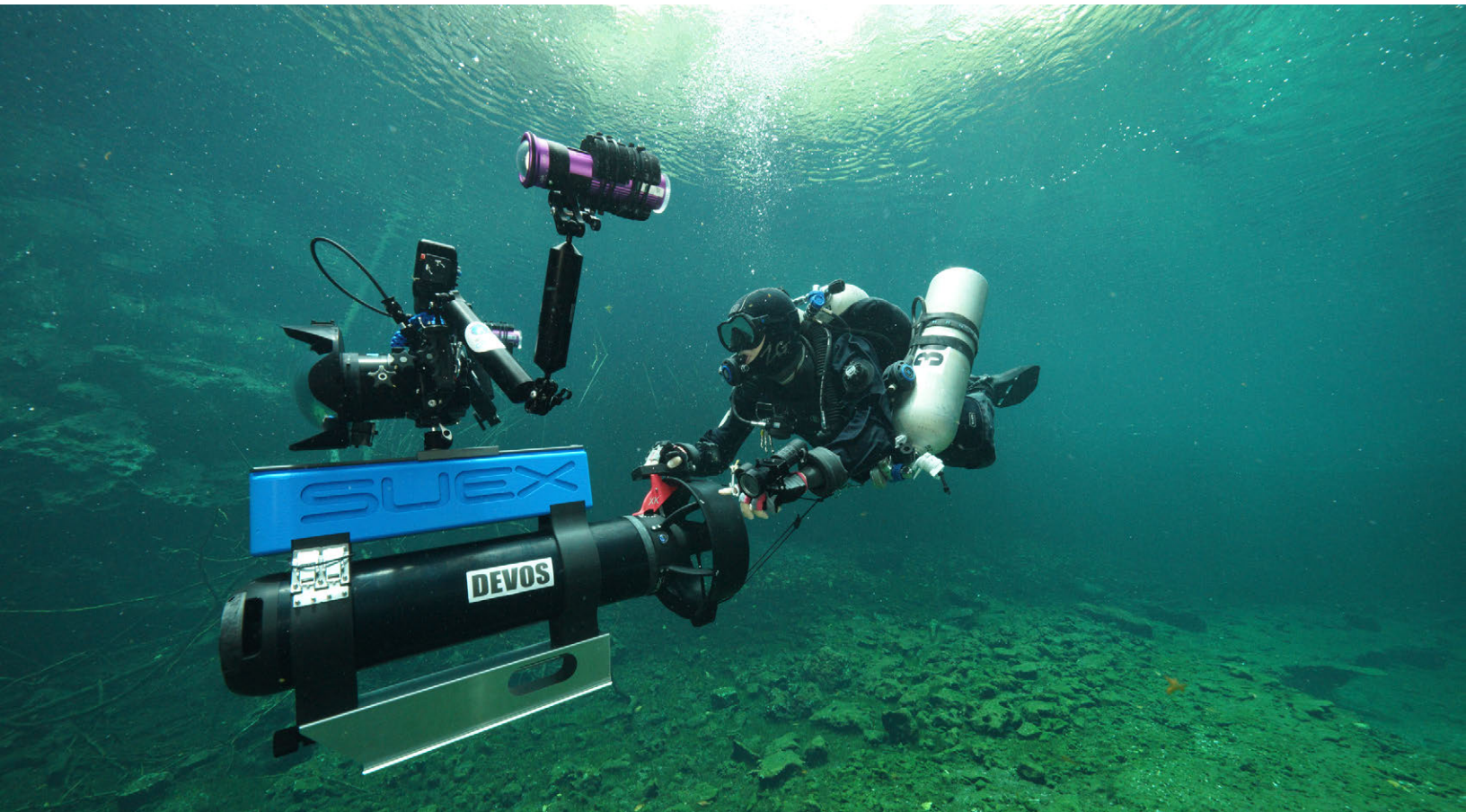
*McMaster University*
*Dr. Eduard Reinhardt*
*Rio Secreto*
*Otto Von Bertrab*
*Tania Ramirez*
*Raul Padilla*
*UNAM*
*Dr. Fernando Álvarez*
*CONANP*
*Biol. Angel Omar Ortiz Moreno - Director of the Sian Ka'an Biosphere Reserve*
*Woodville Karst Plain Project (WKPP)*
*Global Underwater Explorers (GUE)*
*El Ejido Jose Maria Pino Suarez*
*Tony Laviada*
*Alex Manforte*
*Don Otilio Ruiz Cruz, Doña Catalina Manuela Ortega y Adolfo Ruiz*
*Cecilia Niño*
*Don Armando Romo*
*Fundación Selva Maya AC*



## 2021 EXPLORATION/RESURVEY TEAM:

*Alejandro Alvarez, Sigurd Bowitz, Fred Devos, David Dusek, Kirill Egorov, Bruno Espinosa, Julien Fortin, Mark Garland, Osama Gobara, Jose Luis Hernandez, Jeremias Hernandez, Robert Lourie, Chris Le Maillot, Sam Meacham, Alberto Nava, Andreas Rosland, Hens van Oeveren, Flip Vernooij, David Watson*

## MCEP / CINDAQ DECEMBER SCIENCE PROJECT PARTICIPANTS

*Rick Van Beerendonk, Martijn Blommaert, Laurent Dahan, Richard Van De Logt, Fred Devos, Maurits Dobbelaar, Ragna Duquesnoy, Julien Fortin, Peter Gartner, Shannon Hannan, Hervig Hoffmann, Chris Le Maillot, Sam Lensgraf, Stefan Loeve, Sam Meacham, Dr. Alberto Quattrini Li, Dr. Eduard Reinhardt, Dr. Ioannis Rekleitis, Roman Rosenberger, Monica Rosner, Manuela Schoch, Klaus Werzinger, Marios Xanthidis*

## PUBLIC PRESENTATIONS

*In January, Fred gave a presentation about La Mina at the Sayab Planetarium in Playa del Carmen.*

*Sam presented as part of a roundtable discussion on La Mina for the Explorers Club of New York in January. The presentation can be seen on the following link: www.cindaq.org//lamina-explorersclub*

*On January 22, Fred and Chris co-presented at the annual Cave and Wreck night held virtually from Amsterdam, The Netherlands.*

*Sam gave a public presentation to the Nautical Archaeology Society in March. The presentation can be viewed by following this link: www.cindaq.org/NAS-sam*

*Sam also gave a keynote presentation to the Nautical Archaeology Society's annual congress. The presentation can be viewed by following this link: www.cindaq.org/NAS-video*

## PUBLICATIONS

*The following are publications either directly or indirectly associated with the work of CINDAQ for 2021*

*Chatters, James C., Blaine W. Schubert, Vid Petrovic, Alberto Nava Blank, Dominique Rissolo, Joaquin Arroyo-Cabrales, Vera Tiesler, and Pilar Luna Erreguerena (2021). The Macrotaphonomy of Late Pleistocene Human and Animal Remains in Hoyo Negro, Quintana Roo, Mexico. In Tratamientos Mortuorios del Cuerpo Humano: Perspectivas Tafonómicas y Arqueo Tanatológicas, edited by Vera Tiesler, Centro de Estudios Mexicanos y Centroamericanos, Mexico City, Mexico.*

*Chatters, James C., William O. Adams Jr., Diana Arano Recio, Dominique Rissolo, and Helena Barba Meineke (2021). Use of a Novel, Low-Cost 3D CT-Scan Viewer by the Hoyo Negro Project, Quintana Roo, Mexico. In Proceedings of the Joint International Congress, 9th Arqueológica 2.0 & 3rd GEORES, pp. 534-537. Editorial Universitat Politecnica de Valencia, Spain.*

*Huang, Corly, Qiming Chen, Vid Petrovic, Dominique Rissolo, and Leanne Chukoskie (2021). Interactive Game-Based Exploration of an Underwater Paleontological Site. Proceedings of the 7thInternational Conference of the Immersive Learning Research Network (iLRN), pp. 85-89. Immersive Learning Research Network.*

*Sullivan, Richard M. , Peter J. van Hengstum , Jeffrey P. Donnelly, Anne E. Tamalavage , Tyler S. Winkler , Shawna N. Little, Luis Mejita-Ortiz , Eduard G. Reinhardt, Sam Meacham, Courtney Schumacher, Robert Korty (2021) Rising Hurricane Activity During the Maya Classic and Postclassic Period. Ready for submission.*

## THESES/DISSERTATIONS

*Przybyla, Joy (2021). Chen Mul Modeled Type Effigy Censers, Maya Caves, and their Relationship with Ritual Practices: Emerging Evidence from Quintana Roo, Mexico. Masters Thesis, Department of Anthropology, Georgia State University.*

## CONFERENCE PAPERS AND POSTERS

*Calantropio, Alessio, Dominique Rissolo, and Evan Kovacs (2021). Pre- and Self-Calibration of Underwater Cameras for Photogrammetric Documentation of Submerged Archeological Sites. Paper presented at Arqueológica 2.0 9thInternational Congress/3rd GEORES-Geomatics and Preservation, Valencia, Spain (virtual).*

*Chatters, James C., William O. Adams Jr., Diana Arano Recio, Dominique Rissolo, and Helena Barba Meineke (2021). Use of a Novel, Low-Cost 3D Ct-Scan Viewer by the Hoyo Negro Project, Quintana Roo, Mexico. Paper presented at Arqueológica 2.0 9thInternational Congress/3rd GEORES-Geomatics and Preservation,*

*Valencia, Spain (virtual).*

*Chatters, James, PhD (2021). Surmounting the Problems of Radiometric Dating in the Submerged Caves of the Yucatan: The La Mina and Hoyo Negro Examples. Geological Society of America Annual Meeting, Portland, Oregon, USA, October 10-13, 2021.*

*Chatters, James C., Dominique Rissolo, Alberto Nava Blank, Vid Petrovic, Blaine Schubert, Helena Barba (2021). Documentación Digital y Acceso Virtual de la Cueva Sumergida Hoyo Negro, Quintana Roo, México. Paper presented at the Congreso Iberoamericano de Arqueología Náutica y Subacuática, Cádiz, Spain.*

*Fortin, Julien, Meacham, Samuel, Devos, Frederic, Le Maillot Christophe, Dorshow, Wetherbee (2021). From Underwater Cave Survey in Yucatan Mexico, to Geographical Information System (GIS): Concrete Case Study of Replicable Workflow Linking Data Acquisition to Scientific Data Exploitation. Geological Society of America Annual Meeting, Portland, Oregon, USA, October 10-13, 2021.*

*The presentation can be viewed here: www.youtube.com/watch?v=MUUBN2ZSQIA*

*Huang, Corly, Qiming Chen, Vid Petrovic, Dominique Rissolo, and Leanne Chukoskie (2021). Interactive Game-Based Exploration of an Underwater Paleontological Site. Paper presented at the 7thInternational Conference of the Immersive Learning Research Network (virtual).*

*Macdonald, B.L., Reinhardt, E., Chatters, J., Late Pleistocene Ochre Mining in The Caves of The Yucatan Peninsula, Mexico. Geological Society of America Annual Meeting, Portland, Oregon, USA, October 10-13, 2021.*

*Meacham, Samuel, Fred Devos, and Christophe Le Maillot (2021). 'La Mina: El descubrimiento, documentación y cartografía de un sitio prehistórico submarino en Quintana Roo, Mexico' presented at the XV Congreso Nacional Mexicano de Espeleología, Playa del Carmen, México. The presentation can be seen here: https://studio.youtube.com/video/CNHo_bzQzBc/edit*

*Reinhardt, E., Conant, A., Kovacs, S., Devos, F., Meacham, S., Calcite Raft Geochemistry as a Groundwater Level Proxy for Paleoindian Access in La Mina (Sagitario) and Hoyo Negro (Sac Aktun) Caves, Quintana Roo, Mexico. Geological Society of America Annual Meeting, Portland, Oregon, USA, October 10-13, 2021.*

*Rissolo, Dominique and Eric Lo (2021). Documentación Digital de la Arquitectura Subterránea de Quintana Roo. Poster presented at the XV Congreso Nacional Mexicano de Espeleología, Playa del Carmen, México.*

*Rissolo, Dominique (2021). An Overview and Synthesis of Paleocoastal Research on the Yucatan Peninsula. Paper presented at the 86th Annual Society for American Archeology Meetings (virtual).*

*Steele, Riley, Reinhardt, Eduard, Zhu, Juliet, Devos, Frederic and Meacham, Samuel (2021). Sediment Accumulations from the Boca Paila Cave System located in the Sian Ka'an Biosphere of the Yucatan Peninsula Provide Evidence on Recent Sea-level Rise and formation of the classic Maya canal system. Geological Society of America Annual Meeting, Portland, Oregon, USA, October 10-13, 2021.*

# SA CONCA 'E LOCOLI CAVE

## PHREATIC/BASE ONE SARDINIA

*Multiple short changes in elevation and shafts required rope work and team effort to move gear.*

*By Andrea Marassich*

**PHREATIC** is a GUE affiliated non profit organization based in Cala Gonone (Sardinia, Italy). We started our operations in 2014, and we are mainly active in the Mediterranean basin and the island of Sardinia. Our projects involve a growing team of volunteers, and we cover a spectrum of scientific subjects, such as environmental processes, geology, speleology, and conservation of delicate ecosystems, including: hypogene environments, groundwater resources, marine caves and their integration with coastal environment.

In Sardinia, Phreatic collaborates with Base One Sardinia for the organization and logistics of all diving operations in support of scientific research, exploration, and documentation of the local cave systems.

### THE MISSION

"Locoli" is a temporary spring located in Montalbo limestone massif, and is included into the UNESCO MaB (Man and the Biosphere) reserve of Tepilora, Rio Posada e Montalbo.

The spring, which literally can submerge the whole valley during winter flooding, forms the entrance to the massive cave system that is hidden beneath Montalbo. The entrance cavern leads to a series of crystal-clear freshwater lakes— the access requires the use of ropes through multiple changes of elevation, while the decorations and speleothems inside alternate with the smooth rocks levigated by water passage.

This is the entrance gate to a series of huge flooded passages of breathtaking dimensions, with obvious signs of a huge aquifer.

The last exploration dive carried out in 2009 by

Rick Stanton led to a collapse in Sump 5; therefore, unfortunately, the present survey only covers the first two sumps.

## THE PROJECT

In August 2021 Phreatic organized a three-week campaign, encompassing both survey, photogrammetry, and exploration.

The underwater portion is accessible after a relatively long dry passage, where cavers and cave divers had to carry all the heavy gear. Subsequently, the series of sumps is difficult from a technical point of view, as the diving profiles involve serious exposures in Sump 3 and 5.

The main challenge is dealing with the geology of the cave, which presents multiple ups and downs to move from one sump to the next. Sump 3 is the most demanding of the five underwater galleries, as the cave drops initially to 45 m/148 ft of depth and then rises to 15 m/49 ft before dropping to 90 m/295 ft, ascending again to 45 m and dropping again to 65 m/213 ft before the final ascent after more than one kilometer at depth. The overall profile and the risks involved in the dry caving sections are the main challenges to be managed.

In order to complete the working goals connected with survey, mapping, photo/video, and research tasks, divers needed to extend their diving time and elected to stay in the cave and set up a bivouac between sumps; the exploration team made a bet and chose to enter the cave with dry tubes and bivouac gear, without knowing where to establish the camp or if it was possible to do. A new dry section was discovered, explored, and surveyed between Sump 3 and 4, which proved to be the ideal location to bivouac and also allowed for minimizing the decompression risks connected with the profile.

The exploration efforts are now divided into two areas:

*Locoli before S1; the beauty of such environments is comparable only to the effort required to dive into the aquifer of Montalbo.*

*During the weeks of the campaign we started gathering data to produce a 3D model of the cave. Peter Brandt ran the photogrammetry gear into S3.*

The newly discovered dry section between Sump 3 and Sump 4, which features massive rooms and high chimneys that potentially connect with a fossil gallery above (Surface ground level is 300 meters above);

Sump 5, whose exploration stopped at a depth of 50 meters and needs to be further investigated at 2400 meters from the exit.

Diving operations required five divers to take shifts using RB80 units and SUEX DrivE Sinapsi systems to map the sumps. Decompression and drive cylinders were managed, from the surface of S1, by each team without additional support in order to simplify logistics.

The team accumulated 19 dives and a total of 122 hours past S1, surveying all five sumps and dry sections.

## GOALS 2022

We are working on new project sessions for summer 2022.

Considering the importance of the karst system of Montalbo and its water reservoirs, the UNESCO MaB reserve decided to support the project, specifically in relation to the documentation and conservation efforts. We also received the sponsorship of the Italian Speleological Society and are now searching for more partners.

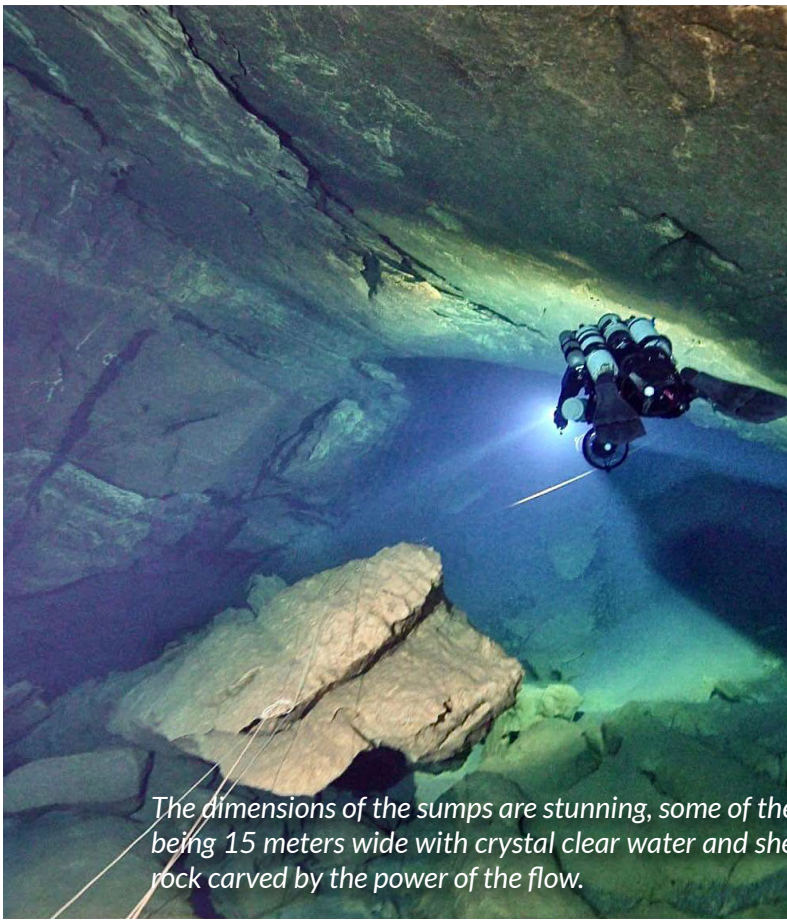
## MAIN OBJECTIVES 2022 WILL BE

Completing the survey of the upstream section, and finalising Sump 5 survey. To perform this task, we will use the SUEX DRIVe combined with MNemo;

Creating a documentary of the expedition with the help of an expert videographer and performing the photogrammetry of the most beautiful passages of the cave;

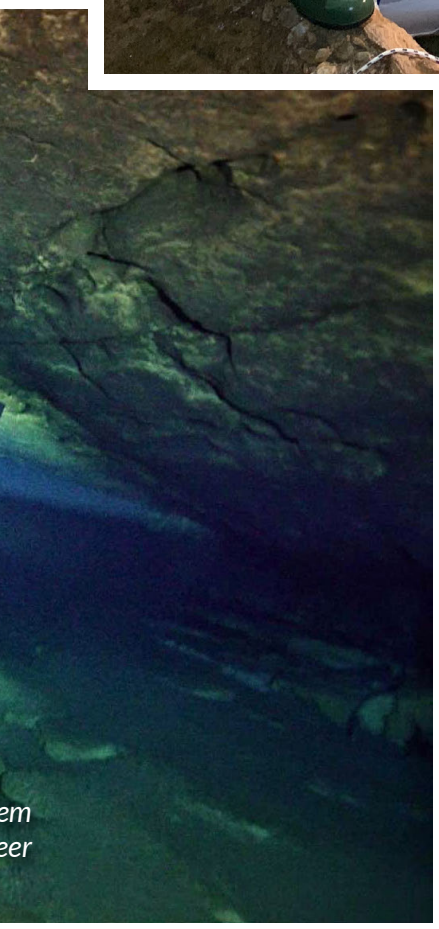
Improving public awareness about caves and karst, in partnership with the International Year of Karst and Cave initiative by the International Union of Speleology.

The Locoli project is carried out in collaboration with Speleoclub Nuorese and is run under the



*The dimensions of the sumps are stunning, some of the being 15 meters wide with crystal clear water and she rock carved by the power of the flow.*

*All the gear was transported through the lakes on a small inflatable. Could have been the first shipwreck into a cave....*



*em*
*eer*

supervision of the geologist Dr. Francesco Murgia, author of multiple scientific publications on the hydrology in the area of Montalbo and Supramonte.

## DIVE TEAM

*Jan Medenwaldt, Peter Brandt, Keith Kreitner, Sven Bertelmann, Andrea Marassich. Laura Marroni, Elke Riedl support divers. Irene Homberger, Sarah Hobson support. Dr. Francesco Murgia scientific coordinator.*

## FOLLOW US

*Website: www.phreatic.org*
*Facebook: https://www.facebook.com/phreatic.org*
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# CREATIVELY EXPLORING THE RED SEA

## GUE CREATIVE TRIP 2021

*By Amanda White*

**EACH** year, GUE makes a trip to the Red Sea, in Egypt, with the goal to drink coffee, go diving, and most importantly, capture photos and videos. Anyone from a GUE Recreational Diver Level 1 and up can join for a week-long adventure with multiple dives a day at some of the best dive sites in the world. With the global pandemic continuing to be a factor, we thought we would miss the trip again this year, but we were able to follow travel guidelines and gather with friends old and new for a very successful trip. This year the Creative Trip was sponsored by Fourth Element, DAN Europe, Halcyon Dive Systems, Red Sea Explorers, and GUE.

### MODELS

*Dorota Czerny, Kasia Puchalska, Christian Höing, Rick van Beerendonk, Faisal Khalaf, Mikolaj Zielinski, Robert Zawrzel, Lauren Fanning, Amanda White*

### CREATIVES

*Andrei Voinigescu, Julian Mühlenhaus, Imad Farhat, Sven van den Heuvel*

### SPONSORS

*Red Sea Underwater Explorers, DAN Europe, Halcyon Dive Systems, Fourth Element*

PHOTO JULIAN MÜHLENHAUS

PHOTO JULIAN MÜHLENHAUS

PHOTO JULIAN MÜHLENHAUS

PHOTO IMAD FARHAT

PHOTO ANDREI VOINIGESCU

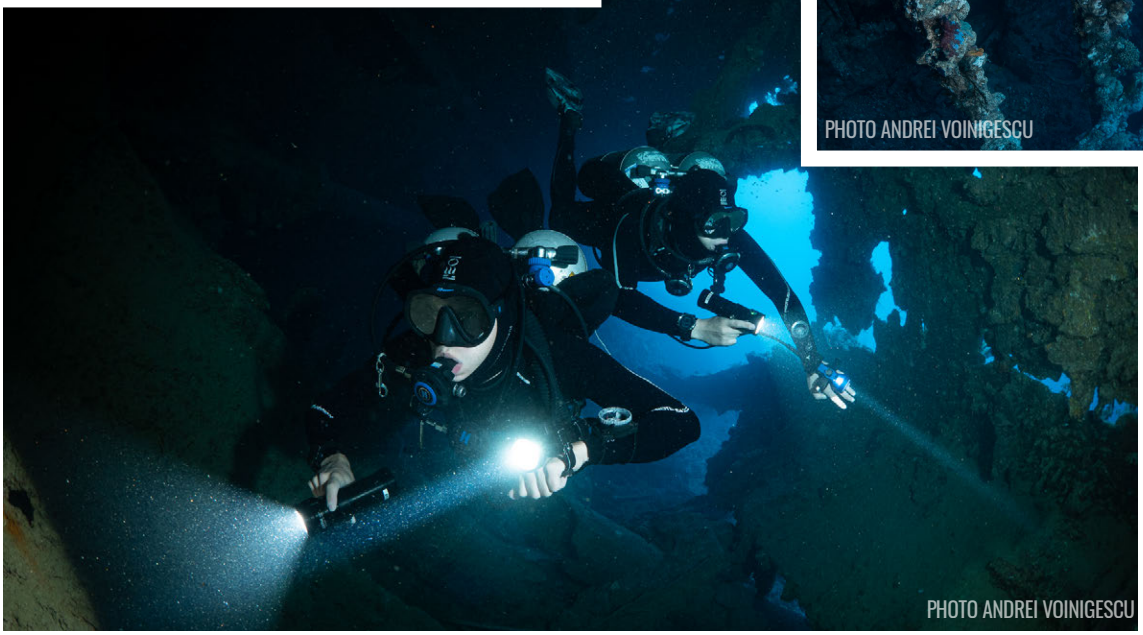

PHOTO ANDREI VOINIGESCU