Volume 3 – $9.99 · €8.95

EXPLORE

The 2018 collection of Global Underwater Explorers featured diving projects

WRECKS CAVES & REEFS

SWEDEN
SCIENCE AT THE EXTREME

ITALY
FINDING THE ROMANS

MARSHALL ISLANDS
A TICKING TIME BOMB

THE PHILIPPINES
THE MYSTERIOUS PRINCESS

34 GUE projects in 18 different countries

GLOBAL Underwater Explorers

Published in High Springs, Florida, USA

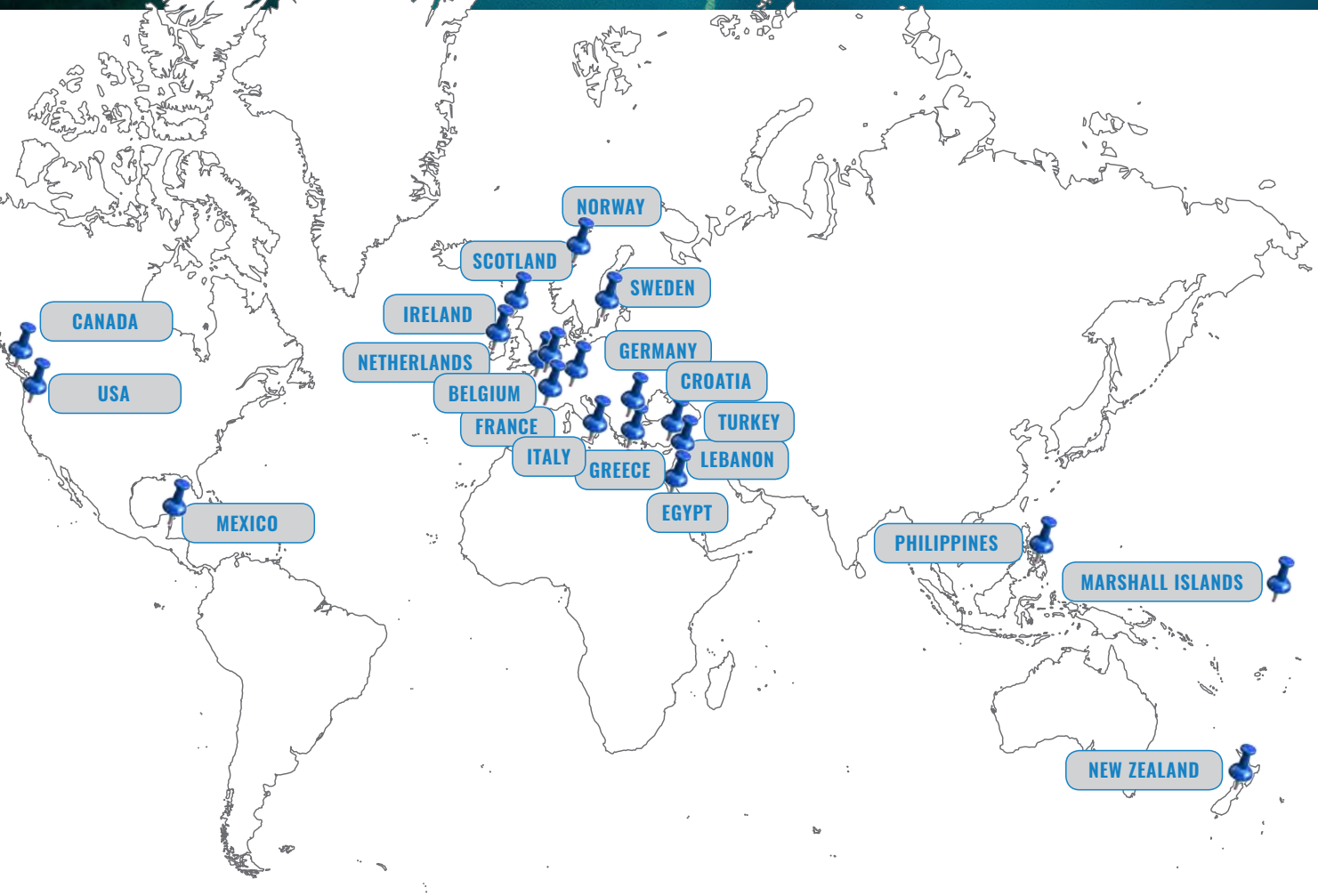
PHOTO KIRILL EGOROV

CONTENTS

ACKNOWLEDGEMENTS

PROJECT COORDINATOR Mario Arena
EDITING & ART DIRECTION Jesper Kjøller
LAYOUT Amanda White

COVER PHOTO
KIRILL EGOROV



ABOUT GUE

Global Underwater Explorers is building global communities of passionate divers, empowered by high-quality training and organized to support wide-ranging diving activities. These communities contain and partner with dedicated explorers, conservationists, and scientific researchers to conduct a diversity of aquatic initiatives around the world.

GUE IS COMMITTED TO:

- Undertaking and promoting underwater research
- Pursuing global underwater exploration
- Safeguarding the integrity of the underwater world
- Providing the public with a comprehensive resource on all things aquatic

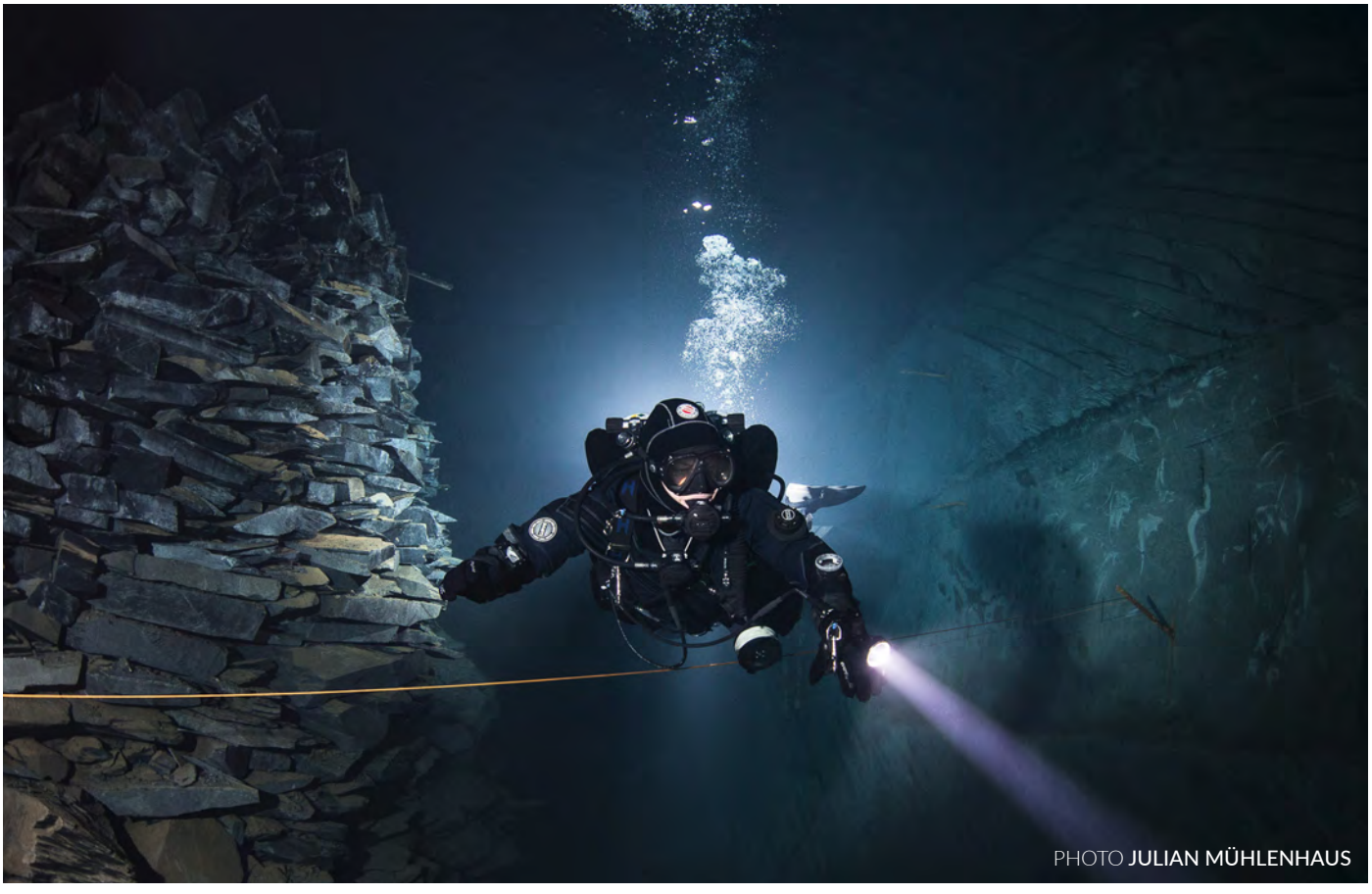


PHOTO **JULIAN MÜHLENHAUS**

PHOTO **JULIAN MÜHLENHAUS**

SWEDEN

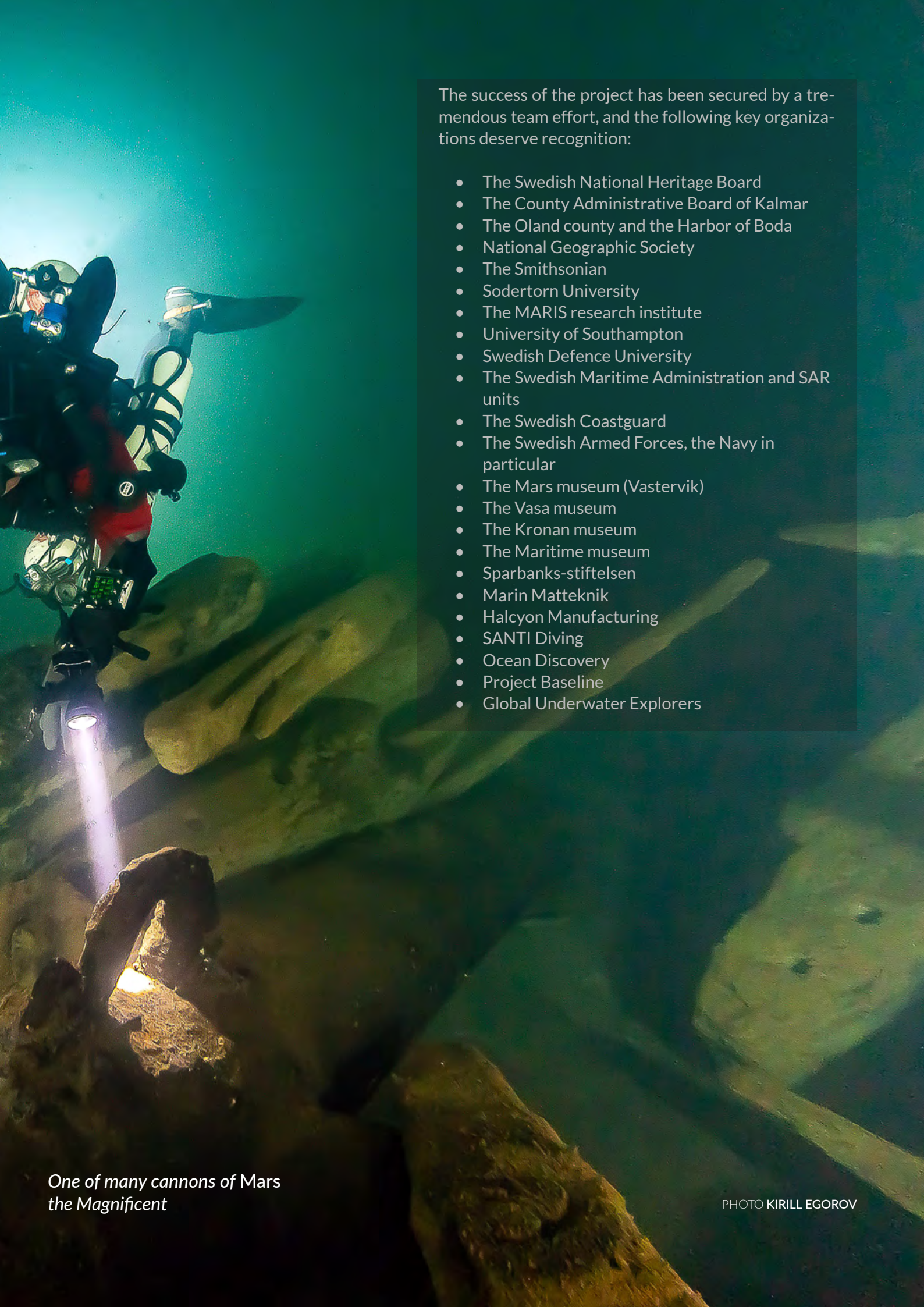
MARS THE MAGNIFICENT

SCIENCE AT THE EXTREME

Global Underwater Explorers has played a fundamental role in both the discovery and the ongoing scientific research efforts on *Mars* the Magnificent.

For a decade, GUE aquanauts have executed close to 1,000 dives, 2,300 hours, exploring and documenting the wreck site. This with a perfect safety record. Major tasks performed by the divers have included:

- Creating a baseline map of the entire wreck site and the debris field, allowing the wreckage, artifacts, and objects to be georeferenced with precision.
- Creating a high-resolution 3D model of the wreckage and the surrounding debris field. More than 40,000 images are currently utilized in the ever-expanding model. The model allows scientists to study the wreckage and the thousands of artifacts in detail, and to perform advanced and accurate measurements, all without ever leaving the office. The 3D model is also used in a virtual reality application intended for museum exhibitions.
- Being part of developing and refining modern non-intrusive archeology methods.
- Clearing and recovering objects and artifacts of significant importance intended for further studies, conservation, and museum exhibitions.
- Photo and video documentation of the wreckage, artifacts, and objects, as well as the scientific process.
- Creating context by surveying the relationship and spread of the objects and artifacts found on the wreckage and debris field.
- Creating awareness and engaging the public by producing TV and film documentaries, magazine articles, and social media content.
- Creating a digital elevation model (DEM) using photogrammetry, georeferenced and quality checked by the use of diver-positioned 3D multibeam sonar systems.



The success of the project has been secured by a tremendous team effort, and the following key organizations deserve recognition:

- The Swedish National Heritage Board
- The County Administrative Board of Kalmar
- The Oland county and the Harbor of Boda
- National Geographic Society
- The Smithsonian
- Sodertorn University
- The MARIS research institute
- University of Southampton
- Swedish Defence University
- The Swedish Maritime Administration and SAR units
- The Swedish Coastguard
- The Swedish Armed Forces, the Navy in particular
- The Mars museum (Vastervik)
- The Vasa museum
- The Kronan museum
- The Maritime museum
- Sparbanks-stiftelsen
- Marin Matteknik
- Halcyon Manufacturing
- SANTI Diving
- Ocean Discovery
- Project Baseline
- Global Underwater Explorers

One of many cannons of Mars *the Magnificent*

PHOTO **KIRILL EGOROV**

COURAGEOUS FIGHT

The year of our lord 1564 on the 31st day of May outside a stormy Swedish coastline. The smoke from the fires is thick. Heat and poisonous fumes from gunpowder is mixed with screams of terror and agony. The sound of blades hitting steel, continuous musket fire, and bursting cannon balls is deafening. A cannon ball screams by closely and smashes with devastating force into the railing. Wood and metal splinters cut down gun crews toiling at their weapons on the gun deck. The decks are awash in the blood of the injured crew, making footing treacherous as the youngest members of the crew, the 12-year-old deckhands, pour sand on the bloody deck to allow the gun crews to fight on.

On the top deck of *Mars*, the remaining Swedish soldiers are fighting courageously and repel wave after wave of boarders. The situation is desperate; the ship is on fire, and it is only a matter of time before the fire will reach the magazines. To surrender, and lower the flag, is unthinkable, for this is far from a gentleman's battle. To be captured is to be put to death in the most gruesome way, to serve as deterrence. Only those few of noble blood can hope to be held for ransom. The Danish-Lübeck soldiers are driven by frightening urgency to capture *Mars* and claim her and thus get a share of the ship's bounty. This goal is far more important to the commoner than the royal ambitions of noble lords and kings.

POWERFUL EXPLOSION

Cannonballs from *Mars* and her attacker continue to cross the short distance between the ships, locked together rail-to-rail by grappling lines, weaving a deadly web of smoking destruction. Forty-pound cannon balls hit with the force of a thousand jackhammers, shattering bridge timbers and turning the inside spaces of the enemy ships into abattoirs. Cries of pain are mixed with howls of aggression and anger from the battling soldiers.

Suddenly, a powerful explosion shakes *Mars*, forcing the deck to lift upwards and throwing the battling combatants to the deck. *Mars* struggles in what is clearly the last moment of her life, and her eventual demise is a foregone conclusion. This is the end for *Mars*, and the once glorious battleship is sinking. Swedes and Danish-Lübeck alike desperately try to leave the sinking ship while the heat from the burning *Mars* causes the water around her to boil like the devil's own cauldron. An enormous cloud of steam rises, like a ghost, out of the ocean. *Mars* the Magnificent is nowhere to be seen.

SWEDISH WAR OF LIBERATION

A fragile peace is all that remained after the signing of the treaty in 1524, when Sweden broke out of the union with Denmark and Norway. The hatred among the Swedish nobility toward the Danish king, Christian the Tyrant, did not fade, and the memories of the horrors and humiliation of the Stockholm Bloodbath was still fresh in people's minds. Revenge and the dream of finally breaking free of the oppression, thereby giving birth to a nation unchained, was on Swedish King Erik XIV's mind. This historical event is reminiscent of the American War of Independence; however, the Swedish War took place hundreds of years earlier and was much more brutal.

WAR AND HEROISM

Mars sank on the 31st of May, 1564, after a brutal two-day naval battle involving more than 60 man-of-war ships. Despite this ultimate defeat, *Mars* succeeded with something extraordinary, something that had previously never happened in history. She sank one of the enemy's admiral ships with her cannons alone. During the dramatic finale of the battle, *Mars* finally succumbed, having been abandoned by the Swedish fleet and despite a desperate defense and countless heroic actions. The ship was boarded and fire spread, leading to a tremendous explosion that sent the fore mast into the sky like a shooting missile. *Mars* sank below the surface, still burning, while water boiled and steam rose around her, creating a ghostly figure. The ghost looked to the north with a sad expression but soon dissolved with a gasp of the wind. *Mars* was lost, but in so doing, she gave birth to a legend that survived for 447 years.

THE DISCOVERY

The sensational discovery of the legendary ship *Mars* the Magnificent made headlines around the world in 2011. After a 20-year search, a group of divers finally discovered what proved to be an undisturbed wreck site and battlefield. It was clear from the beginning that the discovery of *Mars* and her preserved wreck site was a sensation with no equal anywhere in the world. *Mars* was probably the largest and most capable warship of her time, and she was considerably larger than *Vasa*. *Mars* was outfitted with 121 bronze cannons, compared with "only" 72 cannons onboard *Vasa*. *Mars* is truly one of the most magnificent archaeological discoveries of our time.

The discovery of *Mars* was made only after an epic 20-yearlong wreck hunt involving survey of a multi-

A view of the stern of the Mars *and what is suspected to be the admiral's cabin*

PHOTO **KIRILL EGOROV**

Cooking pot that was found in the debris field off the main wreck site

PHOTO KIRILL EGOROV

million-square-meter search. The story involves the efforts of a small group, determined to carry on a childhood dream of adventure and discoveries. The story behind the discovery is a story of adventures at sea and drama on land, when two unevenly funded teams competed to make the discovery of a lifetime. It is a true underdog story, where the most determined team ended up making the discovery, but at the same time healing a lost friendship and bringing two teams back together, leaving only winners.

THE WRECK SITE

The *Mars* wreck site is large and complicated. The wreckage is spread out over 500 meters, and it is actually possible to follow the final hours of the battle step-by-step from the traces it has left on the sea bottom. Cannon balls, parts of the rigging, and masts, as well as personal artifacts and parts of bones, are evidence of the brutality of war. The main wreckage itself, including both hull sides, is relatively intact in the middle of this area. Cannons of different dimensions and calibers litter the seafloor in unprecedented numbers. Everything that was on board during the time of sinking is still there, resting in the dark, including the legendary war treasure that King Erik XIV entrusted to Admiral Jacob Bagge.

THE TREASURE

The legend speaks of a large treasure that followed *Mars* to her watery grave. Historical documents reveal that that King Eric XIV indeed loaded a war treasure on *Mars*. The intended use of the treasure was buying a mercenary army. The treasure consisted of 220 thousand silver and 4,000 gold coins, making it by far the largest in the Baltic Sea. During 2012, the dive team discovered the treasure and the legend came alive! Coins have since been recovered and preserved for museum exhibition.

DOCUMENTARY

Ocean Discovery, in cooperation with Deep Sea Productions, is producing a documentary TV series focusing on sea battles. The story of *Mars* is the starting point of this series, which will feature science, dramatizations, and reenactments. Computer animations will allow the viewer a chance to experience how naval battles were fought and how mighty warships like *Mars* the Magnificent once ruled the seas. Production

A diver peeking into the suspected admiral's cabin

PHOTO **KIRILL EGOROV**

has already commenced and will follow the divers' and scientists' progression during the following years. Cameras with five times the resolution of high definition TV, along with advanced light riggings, will allow the dramatic wreck site to be captured in all its glory. Books, articles, and scientific reports are also in production.

EXHIBITION

For 447 years, *Mars* has rested undisturbed on the bottom of the Baltic Sea. In that time, the crown jewel of the Swedish fleet, once a brutal expression of a newly formed state's growing ambitions, has been transformed into a shipwreck. Many years have passed, and time has taken its toll, but the brackish waters of the Baltic have preserved the ship well, and it can now be viewed as a priceless time capsule. The discovery of *Mars* unleashes amazing new insight and knowledge about life during the 16th century and this eventful period of shipbuilding and evolution of naval battle tactics. *Mars* the Magnificent is now exhibited at the Västervik Museum. In 2013, the exhibition was expanded, and some of the unique silver coins that were recovered during 2012 were on display. Future plans include the addition of cannons and other objects to the exhibit, making it truly unique.

SCIENCE AND NEW TECHNOLOGIES

Assisted by high-tech sonar equipment, the wreck site continues to be surveyed and mapped with great accuracy. A 3D model has been created in order to digitally rebuild the ship in all its might and splendor. This 3D image gives a fantastic overview of the entire wreck site, something crucial for battlefield archaeology and equally important for visitors at exhibitions and museums. A variety of science projects focused on many different aspects of *Mars* are also in progress. Life on board a 16th century warship during battle, ship building techniques, metallurgy studies of cannons, and the role of warships in society are but a few examples of these ongoing scientific projects. *Mars* sank with more than 800 combatants and sailors on board. They have left numerous remains and artifacts that enable scientists to create and describe life on board and also offer a glimpse of 16th century life. *Mars* is incredibly unique, a closed and undisturbed time capsule, waiting to provide answers to a steadily growing number of questions.

WHY *MARS* IS TRULY MAGNIFICENT

- She is the the largest man-of-war of its time! A new design with more bronze cannons than any ship before her.
- A ship sinks in the midst of one of the most brutal and fierce naval battles ever. More than 60 ships fighting, cannons thundering, ships being boarded. This is a story that doesn't need to be made up; its true history is better than fiction!
- She is a true time capsule. *Mary Rose*, *Vasa*, and *Cronan* were never lost and were already recovered during the time of their sinking. *Mars* has kept her integrity and legends.
- The *Mars* wreck site is unparalleled and unique. The area ia undisturbed, mystic, and intact. Cannons sticking out of port holes. Thousands of artifacts. Treasure mixed with personal belongings and remains. The site is photogenic and the visibility usually good.
- It is the story of the epic 20-year-long wreck hunt.
- The present-day scientific project are moving the marine archeological science into a new era.

IMPORTANT LINKS

The 1564 Maritime Battlefield of *Mars*
www.nationalgeographic.com/europe/exploration/mars/

National Geographic Society Supports Exploration of Famed Swedish Warship *Mars* the Magnificent
press.nationalgeographic.com/2014/07/07/national-geographic-society-supports-exploration-of-famed-swedish-warship-mars-the-magnificent/

Cursed Warship Revealed With Treasure Onboard
Researchers and divers have started studying the secrets the *Mars*, the pride of Sweden's 16th-century navy, has held for 450 years.
news.nationalgeographic.com/news/2014/07/140707-mars-shipwreck-warship-baltic-sea-archaeology-science/

450-Year-Old Cursed Warship Yields Treasure Trove of Artifacts
video.nationalgeographic.com/video/news/140707-mars-shipwreck-vin

Schiffswrack "*Mars*": Kampf um die Ostsee
www.nationalgeographic.de/reportagen/schiffswrack-mars-kampf-um-die-ostsee

Svenskt örlogsfartyg från 1500-talet avslöjar historiska hemligheter
natgeo.se/ur-och-forntid/svenskt-orlogsfartyg-fran-1500-talet-avslojar-historiska-hemligheter

National Geographic Society stödjer utforskning av svenskt krigsfartyg
natgeo.se/om-national-geographic/national-geographic-society-stodjer-utforskning-av-svenskt-krigsfartyg

Researchers explore cursed 450-year-old shipwreck at the bottom of the Baltic Sea
www.foxnews.com/science/2014/07/11/researchers-explore-cursed-450-year-old-shipwreck-at-bottom-baltic-sea/

The Explorers Club Flag #215: *Mars* the Magnificent with Richard Lundgren
www.explorers.org/index.php/news/news_detail/flag_215_mars_the_magnificent_with_richard_lundgren

www.explorers.org/flag_reports/TEC_2015_Flag._Report._Richard_Lundgren__Mars_the_Magnificent__Flag_215__July_2014.pdf

Team to Complete Digital Reconstruction of Sunken Warship "*Mars*"
www.newhistorian.com/team-to-complete-digital-reconstruction-of-sunken-warship-mars/456/

Monster shipwreck: Mystery of the *Mars*
www.smithsonianchannel.com/shows/monster-shipwreck-mystery-of-the-mars/0/3462312

Divers swimming along the incredibly well-preserved section of gun deck with cannons still positioned in the gun ports

PHOTO **KIRILL EGOROV**

ITALY

THE BATTLE OF EGADI

FINDING THE ROMANS

Pudi Ram #8 in the Tonnara Museum in Favignana

PHOTO **LUCA PALEZZA**

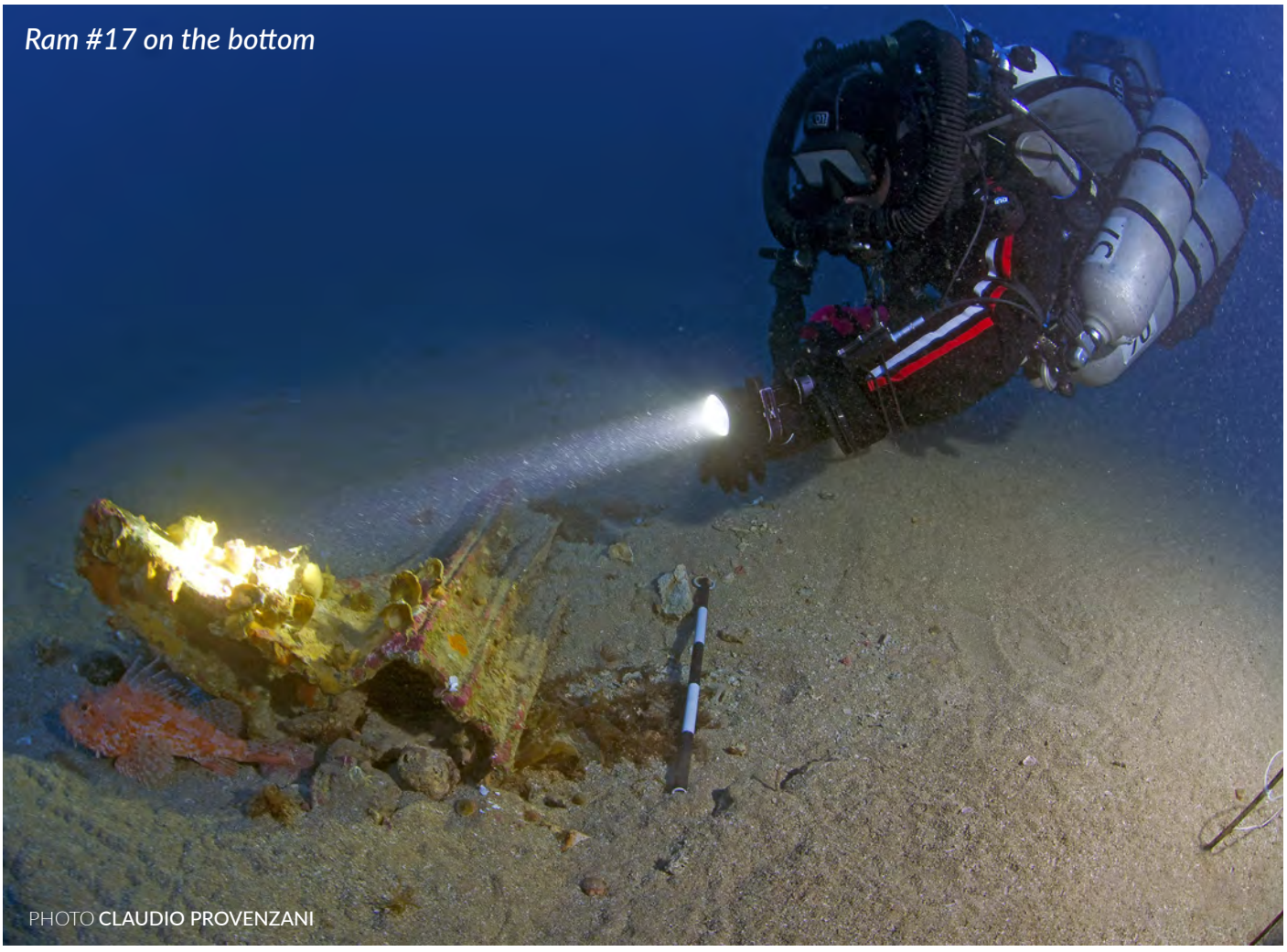
Since 2017, a team of GUE divers has been involved in archaeological investigations at the site of the Battle of the Egadi Islands, which was fought between the Roman and Carthaginian fleets on March 10, 241 BC. The battle between the two fleets involved more than 500 ships and ended with a decisive victory for the Romans, ending the First Punic War, which had lasted 24 years.

After an initial investigation of the Battle of Egadi site in 2017, the GUE/SopMare 2018 Campaign once again demonstrated how effective properly trained scuba divers can be as they operate on the sea bottom. Their expertise served as an integration to surface-based electronic technology by performing surveys, as well as a variety of archaeological tasks, especially at the deeper depths of the site.

The GUE campaign followed a very successful operation run by RPM Nautical Foundation and was characterized by the exceptional discovery of six warship bronze rams and the possibility of extending the defined battle area.

DELICATE CONDITION

The first phase of the GUE operation was in August, when RPM asked to have a team of divers on site promptly in order to help in the recovery of a warship bronze ram (ram #15), which had recently been found. The partially buried ram in fact appeared in delicate condition, and its handling with the ROV presented difficulties and concerns for the integrity of the artifact. A team of four GUE divers was able to free the ram from sediment and successfully recover it to the surface. While positioning the descent line for the team of divers, RPM's ROV discovered another ram (ram #16) less than 50 meters from the position of ram #15. Following this successful cooperation, RPM



Ram #17 on the bottom

PHOTO **CLAUDIO PROVENZANI**

Ram #15 on the deck of RPN vessel Hercules *just after its recovery*

PHOTO **GUE ARCHIVES**

and the GUE teams agreed to collaborate for the continued research in the area.

The GUE/SopMare 2018 Campaign took place between September 18 and October 7. It involved a group of 16 volunteers, among which were 13 GUE research divers who took turns during the three weeks.

ARCHAEOLOGICAL CARE

Considerable effort was required to free the artifacts from sediment and prepare them for recovery while ensuring proper archaeological care and documentation. In particular, warship rams #16 and #18, both located by RPM during the August 2018 campaign, were substantially buried in the sediment and required several hours of excavation before they were able to be lifted onto the surface. Teams of divers defined areas with metal rods and nylon line for further investigation. They took core samples of the sediment in proximity to the warship rams, executed 3D photogrammetry, conducted video and photo documentation, and performed several transects using diver propulsion vehicles (SUEX) to inspect the vast area of the sea floor. Furthermore, GUE divers recovered several artifacts to the surface, including two warship rams and one Roman bronze helmet of the Montefortino type.

The site of the Battle remains an exciting and promising adventure, and yet another research campaign is scheduled for August 2019, which will see GUE divers, archaeologists, and research crews operating together for several weeks while furthering the investigation.

TEAM

Andrea Farnesi, Chanone Park, Claudio Provenzani, Craigh Walker, David Lee, Fabio Portella, Federico De Gado, Francesco Spaggiari, Jan Medenwaldt, Jin Hui, Luca Palezza, Marco Colman, Mario Arena, Piero Labò, Roberto Picciol, Giovanni Polizzi, Edo Salaj, and Elke Riedl

SOPRINTENDENZA DEL MARE

Prof. Sebastiano Tusa, Dr. Adriana Fresina, Dr. Roberto La Rocca, and Dr. Salvo Emma


PHOTO CRAIG WALKER


PHOTO CRAIG WALKER


PHOTO CLAUDIO PROVENZANI


PHOTO LUCA PALEZZA

Top to bottom:
A diver taking a sediment core sample

Ram #16 half into the excavation process on the bottom

Ram #19 on the bottom after the excavation

Team divers pose with ram #19 after its recovery

MCEP AND CINDAQ

In 2018, MCEP and CINDAQ divers celebrated another great year of exciting adventures, including the discovery of 20 new cenotes and 15,000 m/49,000 ft of underwater cave passage!

In 2018, we marked 20 years since we started our exploration of this incredible cave system. Ox Bel Ha is close to 300 km/200 miles today and still has enormous potential for further exploration. We have benefited this year from better access, cutting-edge technology (e.g., scooter, batteries, lights), and our cumulative levels of experience, which allow us to be more efficient and, as a result, accomplish more.

We focused on five distinct areas of the cave this year, revisiting some areas that we had not seen in 15 years. Approximately 12,000 m/40,000 ft of new cave passageway was explored this year using a combination of backmount, sidemount, and semi-closed circuit rebreathers. Additionally, some 6,000 m/20,000 ft of resurvey was conducted in order to improve the quality of our data. We now have the entire cave in Ariane's Line and are using the MNemo cave survey tool to aid in our efforts. Ariane now allows us to superimpose high-resolution orthophotos taken with our drone so that we can better understand how surface activities affects what happens underground.

We were also able to spend time on the ground locating new cenotes and relocating ones we had found in our earlier efforts. Remote sensing techniques and our Mavic Pro drone have increased our ability to target and find new cave openings. A total of 14 new cenotes were either located at the surface or from underwater and connected into our survey data.

One of the high points for us this year was seeing a large mountain lion (also known as a cougar or puma) on two separate occasions as we drove into the site to begin our day.

Ox Bel Ha continues to amaze and inspires us to get out and explore.

PHOTOGRAMMETRY

Over the last year we have focused more on using photogrammetry to document the natural and cultural resources of this region's aquifer. A close relationship with Mexico's National Institute for Anthropology and History (INAH) and the Cultural Heritage Engineering Initiative at the University of California has enabled us to collect and process data for a large model that will document over 200 m/650 ft of archaeologically important cave passageway.

The model currently includes over 8,000 photographs and a dense point cloud of over 2 billion points. The final product will be double that size. Such models provide the scientific community the opportunity to safely enter this environment, observe it, and direct us how to best help with further studies.

We are currently developing more projects for underwater photogrammetry and with our new computer system, we will be able to do some of the processing ourselves. We are all excited about expanding our efforts with this incredible technology that allows us to better understand the aquifer of the Yucatan Peninsula.

We are excited for 2019 and plan to continue our efforts on multiple fronts. We have never been more enthusiastic about what we do than we are now. What motivates us the most is what we still have yet to find!

One of the divers carrying his gear through the jungle for a dive

PHOTO: CINDAO

Two divers going over the dive plan before exploring one of the cenotes

Our video documentation abilities continue to grow with better cameras, brighter lights, more training, and improved computer power. Stay tuned for some of our 2018 efforts to be aired on GUE TV.

LIDAR IMAGERY

Using LiDAR imagery of this area we are able to distinguish slight elevation changes and patterns to better evaluate where cave entrances are located. Working closely with landowners, we are systematically checking off areas. Although the LiDAR technology helps to focus our efforts, the process is still energy intensive.

Our video documentation abilities continue to grow with better cameras, brighter lights, more training, and improved computer power. Stay tuned for some of our 2018 efforts to be aired soon on GUE TV.

XPU REGION

In the past year, hundreds of remote depressions were visited; on average, it took us five days of hiking and 50 targets visited to discover one new cenote. Of the new cenotes found, less than half turned out to have diveable passages leading from them. But the hard work has been well worth it with some amazing discoveries.

Apart from the countless small dry cave openings, we have discovered six new cenotes of which three remain to be dived: Esquina, Vlu, Ox, Killixpach-och, Diamante and De Oro.

ESQUINA

Although an enticing pool of water in this dry cave looked promising, it took lugging heavy tanks and equipment here to determine that the pool was completely sealed and may even have been hand-dug.

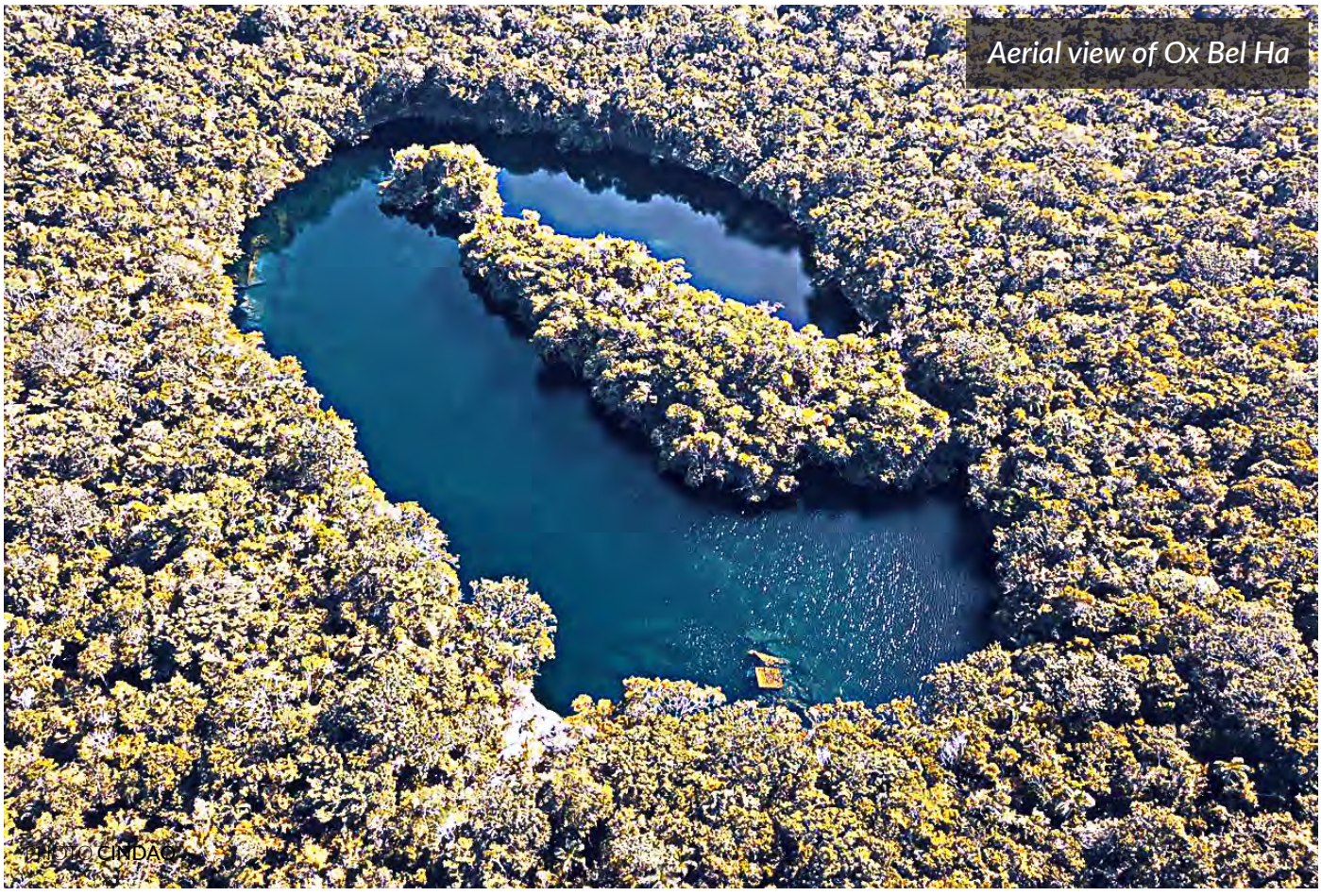
OX

This remote cenote made for challenging logistics, but upstream and downstream caves were established with 673 m/2,208 ft on two visits. Deeper than normal depths and unprecedented percolation will make the continued exploration here challenging.

KILLIXPACH-OCH

Named after the porcupine snoozing in the entrance, this newly discovered cenote was connected to Sistema Sagitario on the initial dive. A subsequent trip established a possible downstream continuation.

PHOTO **CINDAQ**



Aerial view of Ox Bel Ha

PHOTO CINDAQ

SISTEMA SAGITARIO

This cave has been a focal point of our efforts over the past two years. In addition to the connection of Killixpach-och, other exploration in Sagitario added 2,243 m/7,359 ft to the system, bringing the total to 8,399 m/27,556 ft.

Along with exploration and survey work, we have assisted INAH and affiliated scientists in the study of important archeological discoveries made in this cave.

Cenotes Vlu, Oro, and Diamante have not yet been dived, making it difficult to continue typing this report when such exciting diving awaits us.

FURTHER SOUTH...

The small pool of water of Cenote Ko'os was likely a quicksand trap due to the significant number of animal skeletons littering the 137.5 m/451 ft of cave passage. The short underwater passage ends in a sealed CO_2-rich dry chamber with little prospect for any continuation.

Looking at the location of this small entrance, it is likely that Cenote Mosquito will be connected to the Mundo Escondido section of Sac Actun cave system from underwater.

SCIENCE PROJECTS

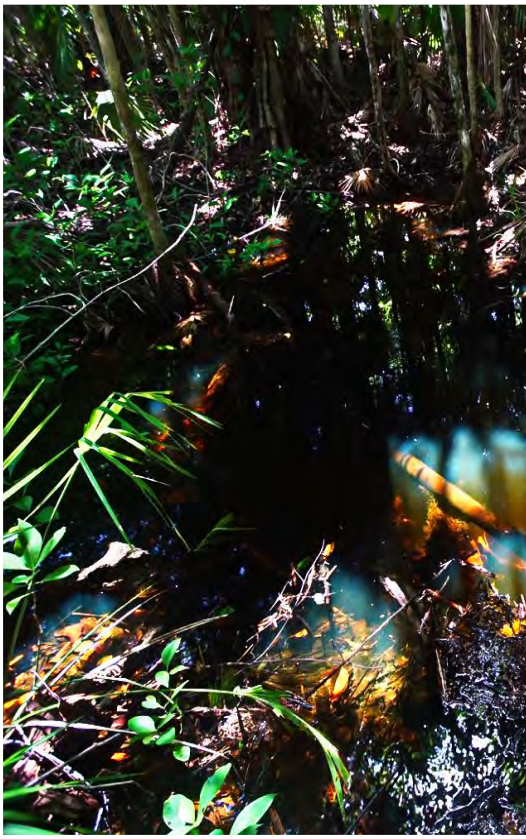
As is tradition in both April and December, MCEP and CINDAQ organized the collaboration of GUE divers and scientists. This year's tasks included algae and calcite sampling, surface pH readings, barometric pressure and temperature measurements, sediment trap management, salinity sensor downloads, depth sensor deployments, and cenote camera management.

Volunteers from 13 countries joined together to help scientists better understand the area's aquifer and other related features.

Calcite rafting in Sistema Sagitario

PHOTO **CINDAQ**

Cenote Esmeralda, one of the crown jewels of Sistema Ox Bel Ha



TEAM

Sigurd Bowitz, Ivo Chiarino, Steve Cox, Fred Devos, David Dusek, Bruno Espinosa, Alessandro Fenu, Marc Garland, Osama Gobara, Chris Le Maillot, Gideon Liew, Sam Meacham, Casey McKinlay, Ali Perkins, Cameron Russo, David Watson, and Blake Wilson

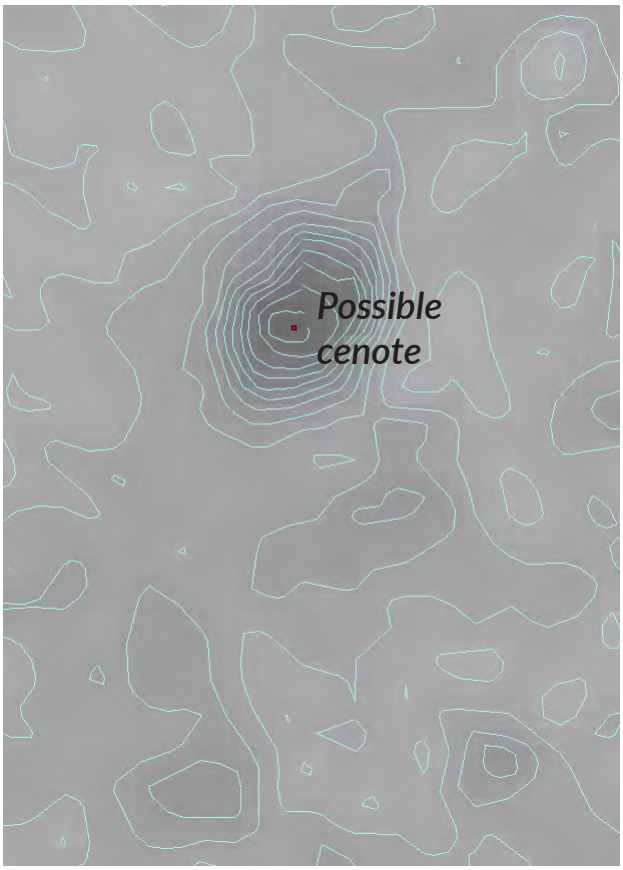
SCIENCE PROJECT DIVERS

April 23-27

Angie Brown, Paul Brown, Ivo Chiarino, Ken Cochrane, Aaron Coutino, László Cseh, Alessandro Fenu, Fred Devos, Anya Krywy-Janzen, Chris Le Maillot, Casey McKinlay, Chelsi McNeil, Levi Page, Ali Perkins, Eduard Reinhardt, Cameron Russo, Flip Vernooij, Alessandro Vezzani, Emöke Wagner, and Hildegard Wiggenhorn

December 4-8

Steve Blanchard, Aaron Coutino, Fred Devos, Julien Fortin, Mathias Frey, Peter Gärtner, and Kyungsoo Kim



CINDAQ/MCEP divers Sam Meacham, Sigurd Bowitz, Chris Le Maillot, and Blake Wilson after a productive week of exploration in Sistema Ox Bel Ha

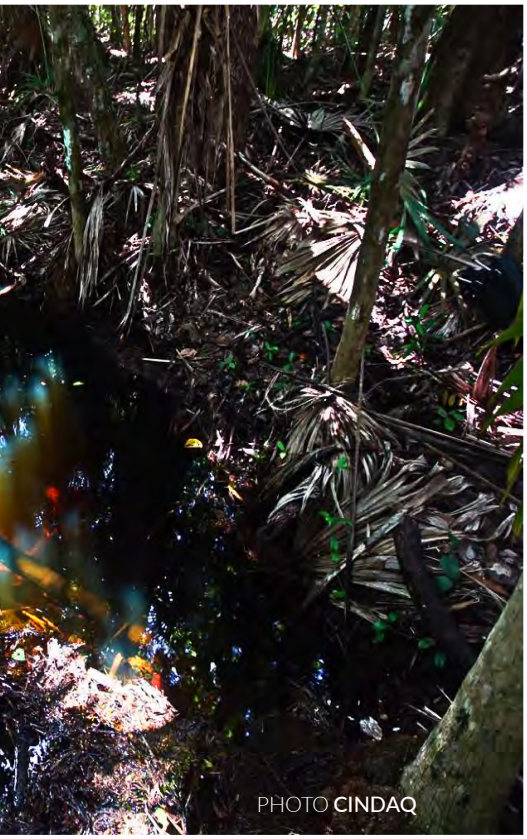


PHOTO CINDAQ


PHOTO CINDAQ

UNDERWATER HERITAGE – KILMORE WRECK

After the successful *Westhinder* project last year, the GUE-Belgium team took up the challenge of documenting another wreck from the Belgian maritime heritage wreck list, the *Kilmore*.

Project goals were to take high resolution pictures of the wreck, make 3D models of key areas, investigate the history of the ship, and create a short documentary and a website. We plan to make Belgian underwater heritage accessible to the general public.

Kilmore was a British cargo ship that sank close to the lightship *Westhinder* on the morning of the 29th of July, 1906. She was on her way from Antwerp to Liverpool with a load of pottery from a factory in Sarreguemines (the north of France). While the ships were trying to pass each other, there was a misunderstanding, resulting in the *Montezuma* hitting the *Kilmore* on the starboard side. After an hour afloat, the *Kilmore* sank. All the sailors were rescued by the *Montezuma*.

The link between this and last year's project is that they are both Belgian maritime heritages, and the sinking of the *Kilmore* happened while passing by the *Westhinder*.

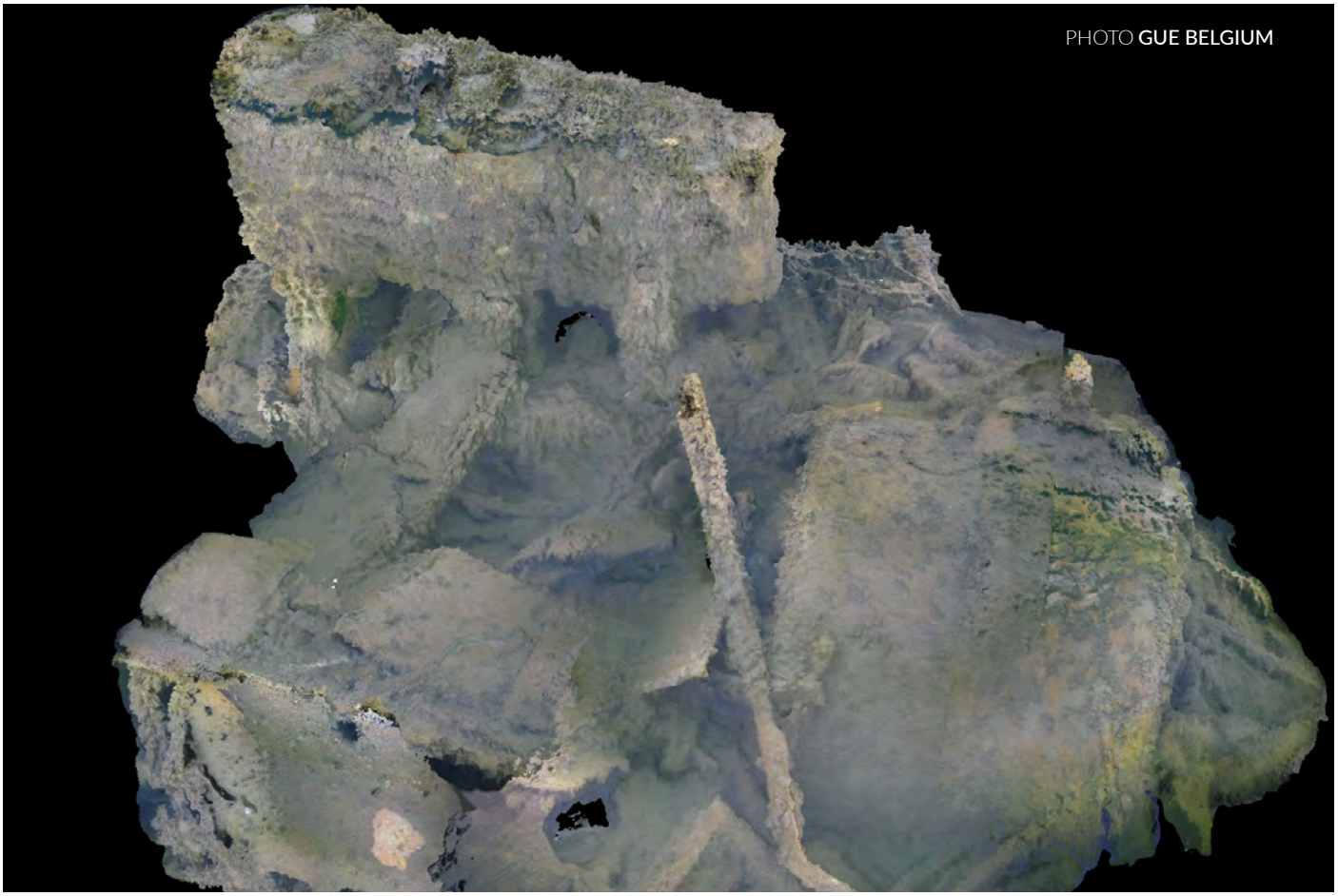
DIFFICULT ENDEAVORS

During four dive days, 32 dives were made—each dive with a specific focus on general survey, video, 3D, photo, or marine biology. The out-of-water research on the wreck became a difficult endeavor since very limited information from this ship survived the test of time. Nevertheless, we gathered enough information to sketch the history of the ship on a website and in a documentary.

Also, 3D modelling proved to be a challenge again, mainly due to bad visibility and the sheer size of the ship. To improve efficiency, we experimented with multi-camera setups. However, this required a couple of dives to tune the camera and light positioning in order to produce reasonable results. With only four dive days, time to experiment was a bit too limited.

TEAM

Johan Wouters, Peter Brandt, Ben van Asselt, Erik De Groef, Laurent Miroult, Leon Joosse, Bart Hoogeveen, Gerrit Leman, Peter Zaat, Ted Schotte, Wannes Engelen, Koenraad Van Schuylenbergh, Olf Smetsers, Dennis ten Napel, Jan van Winkel, Kim Eeckhout, Stéphanne Riga, Raphael Fernandez, Anis Fetouaki, Lucas Marain, Jerome Descamps, Bernard Barre, Tony Neve, Jan van Winkel, Matthias Trappeniers, Melissa Vermeulen, and Simon Van Schuylenbergh



A 3D model of the ship's engine; more photos will be taken to improve the engine model details.

A diver inspecting the propeller

AUDACE

The Italian destroyer *Audace* was originally commissioned by the Japanese Navy to the Yarrow Shipbuilders in Scotland under the name of *Kawakaze*, but was transferred to Italy in 1916 while still under construction.

She was launched on September 27, 1916, and completed on March 1, 1917. The RN *Audace* saw action in the Adriatic Sea during World War I and was the first Italian ship to enter the city of Trieste in November 1918, at the end of the war, finally celebrating the union of the city of Trieste with Italy. The pier where she moored was renamed Molo Audace, or Audace Pier, and her anchor became part of the Victory Lighthouse.

Between the two world wars, the RN *Audace* was reclassified as a torpedo boat and used as the control ship for the targets at the Italian Navy submarine school in Pula. She was rearmed in 1940 for escort duties with her main armament reduced, and was mostly used as an escort in the Adriatic Sea between 1940 and 1943.

SHORT FIGHT

Following the Italian Armistice, the ship left Trieste on September 9, 1943, intending to reach an Italian or Allied-controlled port in southern Italy, but engine problems forced her to make for Venice, where she was captured on September 12 after the Germans occupied the city. She was then commissioned into the Kriegsmarine and renamed *TA20*. The Germans augmented her anti-aircraft armament to 20 Breda guns in 10 twin mounts and assigned her to escort and minelaying work in the Adriatic Sea.

On November 1, 1944, the *TA20*, along with the corvettes *UJ202* (former Italian *Melpomene*) and *UJ208* (former Italian *Spingarda*) were ordered in a troop transport mission. At night, during the navigation, the three-ship convoy was ambushed and attacked in the channel between the islands of Pag and Lošinj by the two British destroyers, HMS *Avon Vale* and HMS *Wheatland*. The two British units, equipped with radar to direct the artillery fire at night, sank the three German ships after a short fight with heavy loss of lives.

EXTENSIVE DOCUMENTATION

The wreck of the *TA20* now lies on its keel 77 m/253 ft deep on a muddy bottom. Her hull remains in one piece from stern to bow, but her structures are severely damaged as a result of the battle, the years submerged, and damage from fishing nets.

The 2018 project on the *TA20*/RN *Audace* was supported by Krnica Diving. The purpose of the project was to document the remains of the ships with pictures, video, and a partial photogrammetry model.

Depth charges positioned on the deck of the ship and ready to be launched

PHOTO LUCA PALEZZA

These would contribute to the making of a book dedicated to the RN *Audace* in honor of the centenary of her arrival in Trieste, which marked the inclusion of the city to Italy after 500 years of Austrian dominion.

The visibility on this wreck was as poor as it has been in the past and did not exceed 5 m/16 ft. Despite this, the divers managed to complete extensive documentation of the wreck during a single dive of 60 minutes bottom time, obtaining the documentation needed for the book and for a video for the Ocean Explorers vlog series.

The documentation of the wreck has also contributed to the creation a 3D model of the ship, allowing viewers to identify the type of armaments on board after the passage to the Kriegsmarine. Realized by Hugo Von Zeschau (www.italiandestroyers.com) using archive drawings and historical pictures, the model has also been used in the book and in the video.

FOR MORE INFO

Book by Ugo Gerini (Italian language):
"*Audace* – 100 anni dopo"
www.luglioeditore.it/libridett.php?cat=3&id=473

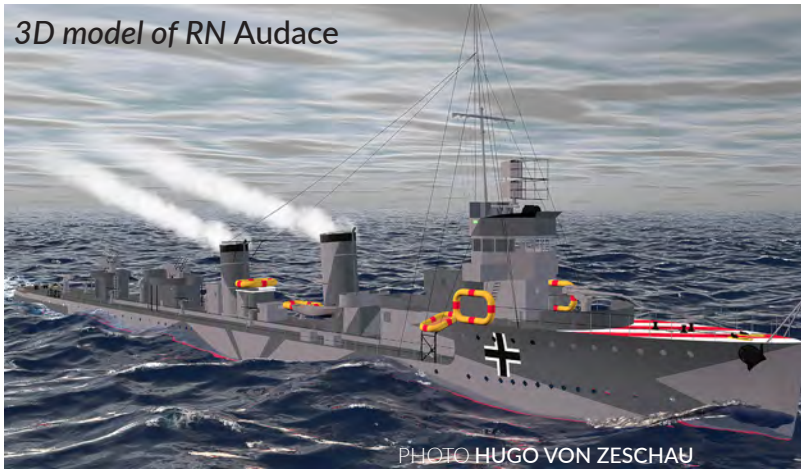
VIDEO BY OCEAN EXPLORERS

youtu.be/CII8to3siuQ

3D model animation by Ocean Explorers
youtu.be/vyOU6n6tfa4

TEAM

Angelo Colla, Rytis Kuodys, Mauro Adami, Nicola Cestaro, Olindo Cren, Stefano Gualtieri, Matteo Giaretta, and Luca Palezza

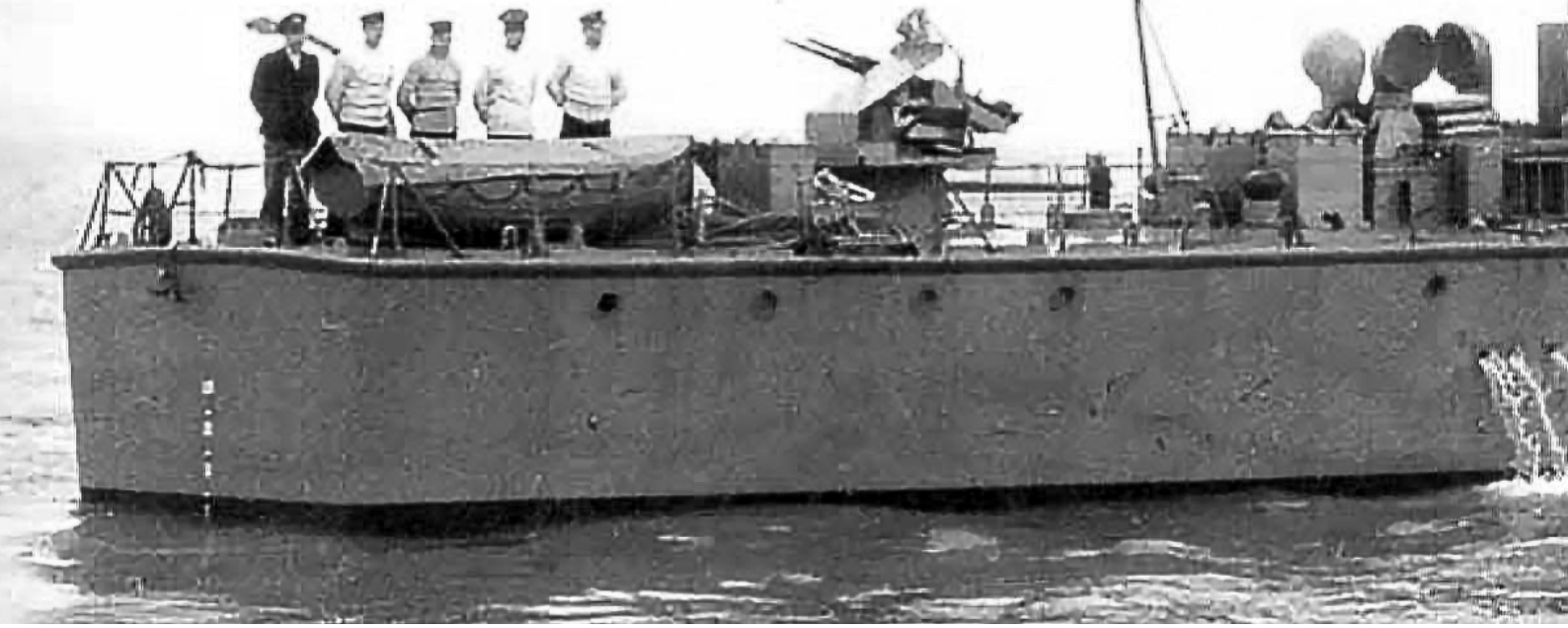


3D model of RN Audace

PHOTO HUGO VON ZESCHAU

PROJECT MTB 655

Fifteen divers from the Netherlands, Sweden, Finland, Japan, Germany, the United Kingdom, and Croatia joined at Krnicadive diving center in Krnica, Croatia, for a new project on the *MTB 655*.



Most divers of the project team have dived in Krnica before, mesmerized by the astonishing wrecks and generally great conditions in Croatia's Istria peninsula, as well as appreciating the professional and fun staff at the dive center. The team consists of several buddy teams; however, most divers were new to one another, and yet quickly became a competent project team.

Diving took place over five consecutive days, with five divers on CCR and eight OC divers on D12s and Suex scooters to support mapping, surveying, and collecting imagery of the wreck. The first day we went out by boat and enjoyed the sunny weather and smooth sailing to the wreck. As there was no buoy to the wreck, the team first needed to locate the wreck and establish a shot-line. On the rest of the days, the logistics were arranged perfectly by Maurizio and his staff, with our own project boat that carried the team and all equipment and photo/survey stuff, supported the divers, and supplied everyone with plenty of water and tuna-pasta for lunch!

SCATTERED PARTS

The *MTB 655* wreck exploded in the Second World War, leaving several parts spread out over the seabed. The boat was approximately 35 m long, and the biggest part of located wreck measures 14 m in length. Navigating the wreck was not complex due to its small scale, but the scattered parts around the wreck and the identified underwater mines made it trickier. In WWII, this area was full of sea mines, which was the cause of the *MTB 655*'s final hour.

The main part of the wreck was identified as *MTB 655*'s middle section, with its canons still intact. Additionally, we discovered some remarkable other parts of the wreck, including the torpedo tubes.

VARIABLE VISIBILITY

The depth of the wreck parts varies from 45 to 58 m. The teams dived in a sequential order; CCRs team(s) went in first and OC teams followed, with intervals of 30 and 60 minutes in between in order to avoid congestion at the wreck and for extended safety during decompression. The CCR teams, which arrived at the wreck first, benefitted from the best visibility and focused mainly on camera work. Many pictures and video were taken to create a 3D model from the main section where deck canons as well as sea mines are clearly visible. The wreck is partially covered by the sandy seabed.

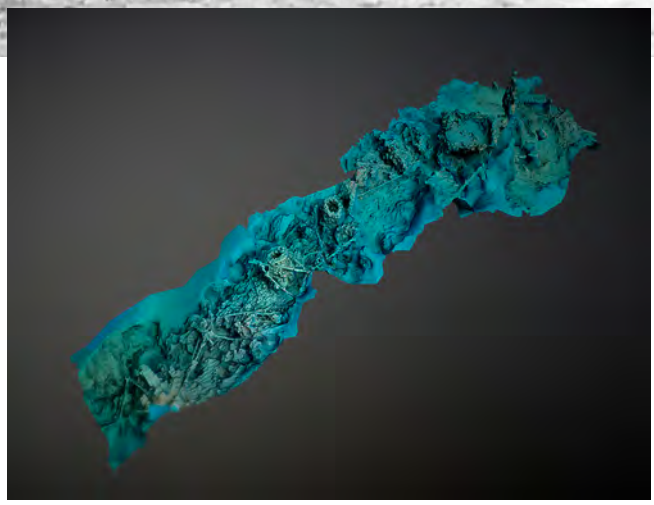
MTB 655 *sank on March 22nd after hitting a mine and had a loss of 9 crew.*

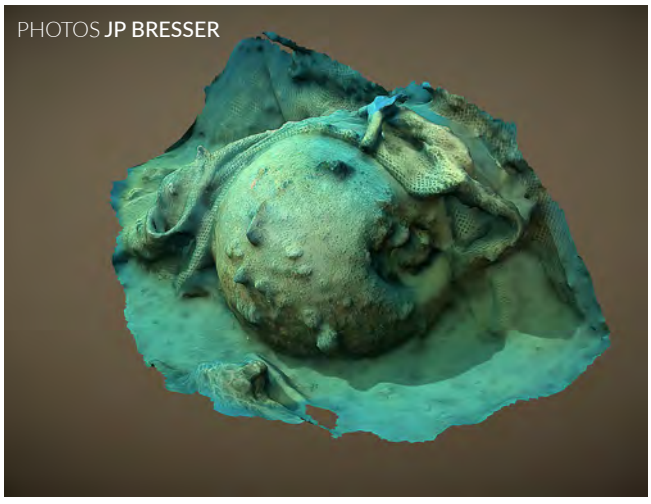
The visibility on the dives was variable, sometimes extremely poor, which made identification of all parts of the wreck hard. With the help of the entire team, making notes, and measuring distances and orientations, we were able to create a detailed map of *MTB 655*. One of the big lessons for the next phase of the project is that even a smaller wreck can be fairly time-consuming to map in detail and requires thorough (sequential) planning of the dives when working with a team.

TEAM

JP Bresser, Alvaro Jiminez, Bart Hoogeveen, Ben Oortwijn, D.J. van Daalen, Erik Jan Bogaers, Fabian Gast, Jimmy Borgh, Matthew Eayrs, Maurizio Grbac, Roel-Jan Mouw, Pirkko Kekalainen, Roger Hovind, Serge Pelikaan, and Yosuke Ogiwara

A big thank you to the staff of Krnicadive dive center who took care of all the filling and other logistics.





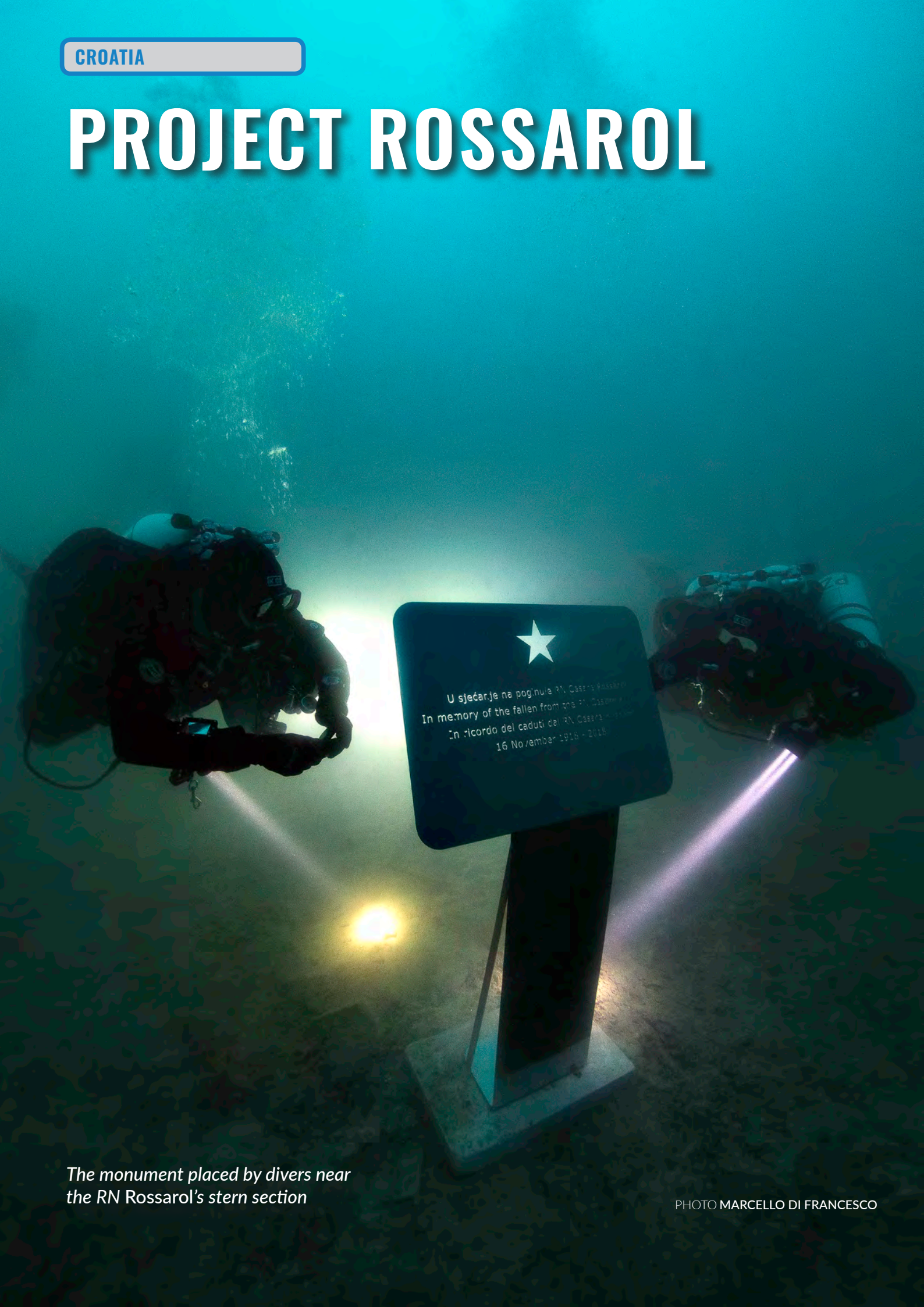
PHOTOS **JP BRESSER**

Top to bottom:

3D model of the main section of the wreck

3D model of a mine near the wreck

PROJECT ROSSAROL



The monument placed by divers near the RN Rossarol*'s stern section*

PHOTO **MARCELLO DI FRANCESCO**

The *Cesare Rossarol*, an 85 m/280 ft long light cruiser of the Italian Royal Navy, also known as the Marina Militare, was built during the arms race preceding the escalation of World War I. Now, it is one of the most famous and historically important shipwrecks in the Northern Adriatic.

After her launch from the Gio. Ansaldo & C. yard in Genua, she was set to service in 1915. On November 16, 1918, she set sail from Pula to Rijeka (Croatia) and sank after an explosion, most likely caused when she collided with a sea mine.

GUE Project Rossarol started in 2014 after a dive on the stern of the *Rossarol* in 2013. The general goals of the project include documenting the current state of the wreck, making the public aware of the wreck, and preserving it for future generations. The project activities in 2014 and 2016 had already produced a considerable amount of documentation to help our team gain a more detailed image of the wreck's pieces and the wreck field.

100-YEAR ANNIVERSARY

The 2018 edition of Project *Rossarol* has been important in many ways. Not only did we try to finish the project and present the results, we paid tribute to the 100-year anniversary of the ship's sinking. The sinking of the *Cesare Rossarol* was a huge material loss as well as a devastating human tragedy, with 93 sailors losing their lives.

Prior to the week of the project, considerable time was spent developing and producing a solid website presenting the full history of the *Cesare Rossarol*, including descriptions of its current state, previous project reports, and a photo and video album. This website went live just a few days before the start of the project week, which ran from September 2-8.

With all the data (measurements, building plans, photo and video materials) collected during previous project weeks and images by other divers, the construction of the 3D model began. First, a 3D model of the ship was made according to the original building plan. This model was compared with both the actual wreck parts on the bottom as well as old photographs of the ship to distinguish any deviations from the original building plan. Then, the bow and stern sections were placed on the bottom and rendered with actual pictures of the wreck parts. The final model is currently online.

CLEANING UP

This year, we reflected on the commemoration of the 100-year anniversary of the sinking of the *Cesare Rossarol*. We placed a monument near the stern of the wreck in memory of those who fell during the tragedy on November 16, 1918. During the project dives we installed the foundation first, and on a following dive, we mounted the stainless steel monument.

In the meantime, other team members cleaned the excess lines, which had been installed during previous project weeks for reference, as well as some of the fishing lines, which continue to pollute the wreck area.

Journalists and photographers from different countries joined team members on the Wednesday of the project week. They witnessed the briefing, the final installation of the monument, and then joined the project presentation in the evening, where the 3D model was revealed. A social event and dinner followed in front of the Krnicadive center. Directly after the presentation, the 3D model became available on the website.

Most project members finished the week by swimming to shore after the dive and visiting the monument for the fallen of the *Rossarol* on the shore of Ližnjan.
In general, the project is completed, but this does not exclude further updates or developments from happening. Some possible updates could be a 3D photogrammetry model, further investigation of the debris section, or cleaning of the wreck site from spoiled fishing lines.

You are invited to check out *www.rossarol.krnica.com* for all project details and the findings of Project Rossarol. Follow us on Facebook for more frequent updates: *www.facebook.com/rossarol*.

TEAM

Barend de Lange, Berry van Leeuwen, Giovanni Grieco, Jeroen Veltrop, Joseph Chroust, Luca Palezza, Margrita van den Akker, Mathijs Geenen, Maurizio Gbrac, Nicole Heuer, and Peter Zaal
Project Partners: Santi Diving, Tecline, K01 Spyder, and KrnicaDive

The team with the monument before it went in the water

PHOTO MARCELLO DI FRANCESCO

Divers lowering the monument into the water

PHOTO ALEX DAWSON


SUEX
SUPPORTING
EXPLORERS
SINCE 1999
SUEX
SUEX
www.suex.it
Derk Remmers

1866: THE BATTLE OF LISSA

A team of GUE divers conducted a documentation project on the wrecks of two Italian ironclads, the RN *Re d'Italia* and the RN *Palestro*, both sunk on July 20, 1866, during the Battle of Lissa.

The naval Battle of Lissa was fought on July 20, 1866, during the Italian independence wars, between the fleet of the Austrian empire and the fleet of the Italian kingdom. Even though the Italians had a greater number of armored ships and more powerful artillery, the battle ended with a decisive victory for the Austrians.

The Italians had sent a task force to conquer and occupy the Austrian island of Lissa in the South Adriatic Sea in order to obtain a position of strength in the peace negotiations, which appeared imminent. The Italian force was made up of a powerful fleet of 28 ships, 12 of which were ironclads, with approximately 10,000 men, at the command of admiral Carlo Persano. Despite being composed of strong and modern ships, the fleet was affected by serious contrasts and rivalries between admiral Persano and the commander of two of the three divisions of the fleet, rivalries which played a determinant role in the defeat.

On the morning of the 20th, when the Italians were engaged in the third day of operations against the Austrian defenses of the island of Lissa and were preparing for the landing of the marine infantry, the Italian fleet was caught by surprise with the arrival of the Austrian fleet composed of 26 ships, seven of which were ironclads, at the command of admiral Wilhelm Von Tegettoff.

CHAOS AND CONFUSION

The engagement between the two formations was fought in several small battles, and there was much chaos and confusion, which was made all the worse by the dense smog of the coal-powered engines as well as from the noise and smoke from dozens of cannons, which completely obscured the battle scene.

The rivalries between the Italian Admiral in chief Persano and his commanders, together with a series of tactical errors committed by Persano, caused the Austrians to defeat the Italians in most of these battles.

In the main clash, involving seven Austrian and four Italian ironclads, a fatal hit destroyed the unprotected helm of the Italian flagship *Re d'Italia*, immobilizing her in the middle of the fray. Taking immediate advantage of the situation, the Austrian flagship SMS *Erzherzog Ferdinand Max*, with Admiral Tegettoff on board, rammed the Re *d'Italia*, causing her to sink in 3 minutes with the loss of 381 crew, including the ship's captain.

In the same battle, the Italian ironclad *Palestro* was hit several times while attempting to assist the *Re d'Italia*, causing heavy fire on board. *Palestro* retreated from the battle, while her crew tried to extinguish the fire. At the end of the battle, when the Italian and Austrian fleets split, regrouping in formations, the *Palestro* sadly exploded and sank with the loss of 210 crew, including her captain.

PHOTO DERK REMMERS

The left flank of the RN Palestro

IRONCLAD BATTLE

The first major battle between ironclads in history was over, and after exchanging gunfire at a long distance, the two fleets finally retreated. Admiral Persano and the commanders of the two other divisions of the Italian fleet were all removed from the service as their behavior was considered the cause of the defeat. The wrecks of the two Italian ironclads lie in 115 m/377 ft and 120 m/395 ft of water and are war graves of the Italian Navy. They were put under the protection of the Croatian archaeological authorities for their great historical relevance, and diving them was not permitted. In 2018, for the first time, limited permission to dive the wrecks was granted by authorities in order to obtain a baseline documentation of the status of the wrecks. This would allow the archaeologists to evaluate and decide on their future management.

A GUE team was authorized to dive the wrecks in August. The operation was supported by the diving center Manta, based in Komiža, Vis Island, and owned by Lorenz Markovic and his son Andrej, which provided outstanding service. It was Lorenz, a former coral fisher, who found the *Re d'Italia* with an ROV, some ten years ago. A representative of the Croatian Ministry of Culture was on board during the operation in order to collect first-hand reports and impressions after the dives, as well as all the documentation materials produced. The team managed to dive each of the wrecks twice, producing video and photographic documentation.

FANTASTIC SITE

The wreck of the RN *Re d'Italia* sits upright on a muddy bottom at 115 m/377 ft. The wreck of the once beautiful and powerful 5,000-ton ship was armed with 38 cannons; she bears an iron ram on the bow, and she was built with a wooden hull covered with armor plates. The shipwreck maintains the defined shape of the ship in the first 30 m/100 ft from the bow, with the ship's sides erect; however, the sides are partially collapsed in places and are entirely missing in others. Between the ship's sides, the wooden decks have collapsed one on top of the other, making the inner part of the wreck a less defined mass, rising from the bottom for several meters in the bow section and gradually fading toward the stern. The stern has no defined shape and becomes a field scattered with parts and debris on the sea bottom. On top of the mass of the collapsed decks lie several big cannons, one of which protrudes from its hatch. Many artifacts can be seen with a close inspection of the wreck, enough to fill a dedicated museum.

The visibility on the wreck is 5-8 m/16-26 ft, the water more murky than clear. The site is fantastic, and the level of conservation is interesting and surprising after more than 150 years underwater.

The wreck of the RN *Palestro* rests on her keel on a muddy bottom, at a depth of 120 m/394 ft. The ship was built with an iron hull and maintains the shape of her bow, with a spectacular ram. Halfway along her 65 m/213 ft long hull, the ship was sharply broken, most likely by the apocalyptic explosion that sank her. Inside the wreck, the decks appear unsafe but still defined, held up by the iron beams of the construction. Most of the destruction appears in the stern section, which was devastated by the fire and the explosion. During both dives, the stern was surrounded by murky water, making it impossible to get a clear idea of its condition. In general, the wreck is in surprisingly good condition and very spectacular when the visibility is good.

The team hopes to be involved in future investigations of these two impressive shipwrecks, and plans are made for more documentation of the sites in 2019.

SPECIAL THANKS

The team deeply thanks Emir Memic for the precious help with permissions and project organization, and SUEX for supporting the project, making five of their top scooters available for the participants who flew in from abroad.

TEAM

Mario Arena, Jarrod Jablonski, Jan Medenwaldt, Luca Palezza, and Derk Remmers

EXPLORING THE NORTHERN RED SEA

SC Almirante Barosso *was a Brazilian sail and steam war cruiser lost in the northern Red Sea in May 1893. It was one of the wrecks discovered and identified in 2018.*

PHOTO **GUE ARCHIVES**

In July of 2018, a group of dedicated GUE divers, including GUE President Jarrod Jablonski, participated in the inaugural trip of the Red Sea Explorers liveaboard operator to locations in the northern Red Sea in pursuit of new underwater discoveries.

The Red Sea Wreck Exploration project aims to find, discover, dive, and identify many potential wreck locations to showcase the reach of naval history in the area. The Red Sea is a well-known dive destination with hundreds of great dive spots, but due to its unique location and the historical significance of the Suez Canal, it still hides undiscovered treasures: wrecks of ships that have been lost over many centuries in those treacherous waters.

Finding new wrecks is a tedious job, especially in an area like the Egyptian Red Sea where sidescan sonar and similar technology is not easy to get access to, nor is permission to operate it. The owner of Red Sea Explorers, Faisal Khalaf, befriended Hamdi, who comes from a family that for generations worked as fishermen in the area. Together, they convinced many of the local fishermen to share over 200 locations in the northern Red Sea around the Suez Canal with them.

Those are the locations where fishermen work; underwater objects (e.g., wrecks) are ideal areas for fish to aggregate, but they are also sites where the fishermen lose their nets and gear. Some of them could be wrecks worth diving, but some are just lost cargo or piles of rocks. However, the project's goal is to find, dive, and document what is on the bottom of the Red Sea!

SCRUPULOUS PLANNING

Throughout the trip, the dive team and the project's operations team learned a lot, gathered valuable experiences, and built up the excitement to pursue discoveries in the unexplored regions of the northern Red Sea.

During the six diving days, the team successfully dived a few new locations, all of which proved to be new wrecks ranging from the 1800s to modern days. The depths of these wrecks range from 65 to 80 m/213 to 262 ft with challenging current conditions during some of the dives. Due to the location of the dive sites—near the shipping lanes of the Suez Canal—scrupulous planning, efficient operations, and well-functioning surface support was required.

One of the explored wrecks in the Gubal Straights is most probably a Brazilian Navy sail steamship cruiser, built in 1880, the *SC Almirante Barroso*. She was a three-masted tall ship with square sails that was circumnavigating the globe when she met her fate in the Red Sea in 1893 after hitting rocks in the Al Zeit area.

The next wreck we identified is a British general cargo, iron screw steamer *Fulica*, built in 1878 by Mounsey & Foster in Sunderland, UK. After two years of service, while en route to Aden with a load of coal, she collided with the SS *Eden* close to Ashrafi lighthouse in the Gulf of Suez and sank.

The Red Sea Wreck Exploration Project aims to discover new shipwrecks; document them using video, photo, and photogrammetry techniques; and identify them to showcase the rich naval history the Red Sea has to offer to all avid wreck divers.

VIDEO LINK

gue.tv/programs/exploring-egypt-northern-red-sea

TEAM

CCR Divers: Jarrod Jablonski, Dorota Czerny, Faisal Khalaf, Daniel Schelvis, and Sameh Sokar

OC Divers: Mostafa El-Damaty and Hazem Hanafi

Support Divers: Peter Barbot and Evan Soukas

BATTLE OF CAPO NOLI – THE GUNBOAT

Off the coast of Northwest Italy, near Capo Noli, at 63 m/206 ft deep, GUE Instructor Marco Colman discovered a bronze cannon and colubrine nearly buried in sediment. This discovery has become the center of an incredible adventure into history and has involved a growing number of researchers, experts, enthusiasts, institutions, and the media.

Marco Colman and Mario Arena, in collaboration with archaeologist Simonluca Trigona of the Archaeological authority of Rgione Luguria, carried out the initial investigation of the site with several dives. Some of the early excavation brought to light three muskets, a pistol, and other minor items. Historian and French Revolution era expert Alessandro Garulla identified the artifacts as belonging to the Revolutionary French Navy. Garulla also recognized the vessel the cannons belonged to as a major ship's boat of the French Navy, probably belonging to the ship of the line, *Ca Ira*, which boasted 80 cannons. The role of these 11-meter boats, which were carried on board of major vessels, was to act as landing crafts to deliver boarders and cutting-out parties during night attacks. Additionally, these boats were also sometimes armed with smoothbore cannons to function as small gunboats. Boats thus equipped would support landing operations and act as picket boats for ships at anchor. When a ship was becalmed, dismasted, run aground, or otherwise unable to move, a ship's boat provided a source of motive power.

It is nearly certain that the boat sank during the Battle of Capo Noli, fought March 13-14, 1795, during the French Revolutionary Wars between the French fleet and allied Anglo-Napolitana forces. The battle saw the first victory of the then-captain Horatio Nelson, commander of the 64-gun HMS *Agamennone*.

SATURATION DIVERS

In July 2018, during a unique archaeological operation, a team of saturation divers of the Italian Navy operating from the submarine rescue ship *Anteo* (A5309), excavated the site for four days. The excavation was directed topside by the archaeologist Trigona and by the historian Garulla in video-voice communication from the ship's diving control room with the divers on the bottom. GUE divers Colman and Arena assisted with the positioning over the site and provided documentation of the operation by performing photogrammetry of the site in the different phases of the excavation process.

The saturation divers extracted a number of items from the sediment, including a second one-pound bronze cannon, the boat's compass, an octant, and several other artifacts. Particularly touching was the discovery of the partial remains of a young French officer and his uniform. The excavation also began to reveal parts of the boat's well-preserved wooden hull.

IMPORTANT EXHIBITION

Beginning in March 2019 in Finale Ligure, there will be an important exhibition dedicated to the Battle of Capo Noli and to the terrestrial battles between the French Revolutionary Army and those of the Coalitions in the Western Ligurian littoral. Organized by Garulla, Trigona, Colman, and their 1795 Foundation, the exhibition will also display the artifacts found on the gunboat of Capo Noli.

GUE Instructor Marco Colman will continue coordinating investigative activities on the wreck site in 2019 under the direction of archaeologist Simonluca Trigona.

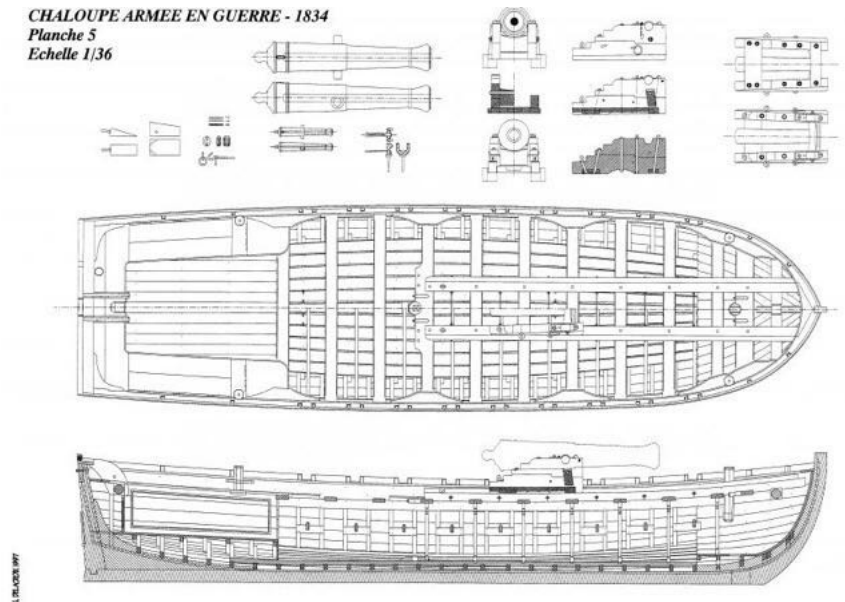
For information, contact marco@gue.com

The perfectly preserved gunboat octant that was recovered

PHOTO MARCO COLMAN

PHOTO MARCO COLMAN

A bottle recovered by divers



BAY OF CAPISTELLO

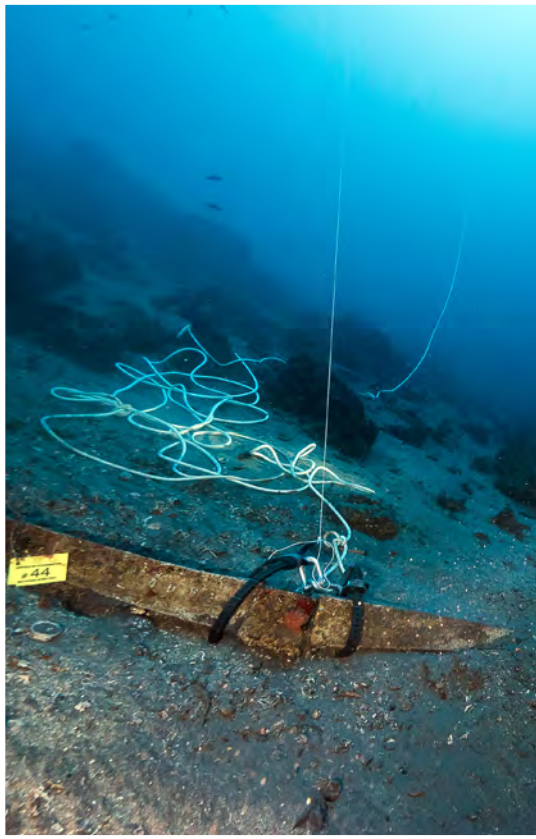
During two campaigns, one in 2016 and one in 2018, a team of GUE divers explored and defined a submerged archaeological area in the bay of Capistello in Lipari island.

Operating in collaboration with the Archaeological Museum of Lipari and the regional archaeological authorities of Sicily, the divers discovered dozens of ancient anchors of Greek-Roman age, a majority of which are of the lead-stock type. Most of these anchors are of huge dimensions, weighing between 200 and 500 kilos; such heavy anchors surely belonged to large ships, big enough to be equipped with strong capstans operated by multiple men or animals that allowed for lowering and lifting such anchors.

So far, the findings include a unique in the world collection of 48 lead stock anchors, together with five rare iron Roman anchors, a number of medieval and modern age anchors of major vessels, the pillar of a leuterion altar, and several transportation amphorae. The remains of a 3rd century BC Greek merchant ship was found lying in the bay with part of its wooden hull and part of the cargo still in place.

VOLCANO SLOPE

Artifacts are scattered on the bottom of the 300-meter-long bay, the steep slope of an inactive volcano, dropping down to 500 meters deep with an inclination of about 40 degrees. The bay provides the first possible repair from the NW storms, the predominant



wind in that area, for the ships that were sailing between the central Mediterranean basin, Sicily, and the western coast of Italy, and it was clearly a frequented anchorage site in ancient times. It remains unclear why ships were stopping in this bay instead of getting to the very near harbor and town of Lipari, which distanced only one mile away. It is surprising that ships were anchoring at depths between 80 and at least 130 meters, depths at which we are now finding most of the anchors.

The many rocks and boulders of various dimensions that characterize the bottom of the bay area indicate the clear cause of the loss of so many anchors: they ended up stuck and were impossible to lift.

EXTRAORDINARY CONCENTRATION

Divers are georeferencing and documenting each of the artifacts using a variety of techniques; the plan is to leave most of the artifacts in their context on the bottom of the bay and create an interactive map of the area. In the future, technical divers will be allowed to visit this unique and extraordinary concentration of archaeological materials, guided by the survey map, while immersed in the beautiful, clear waters of the underwater environment of the bay.

Divers will also be able to contribute to the refinement of the map with additional data and findings, as well as help improve and maintain the site.

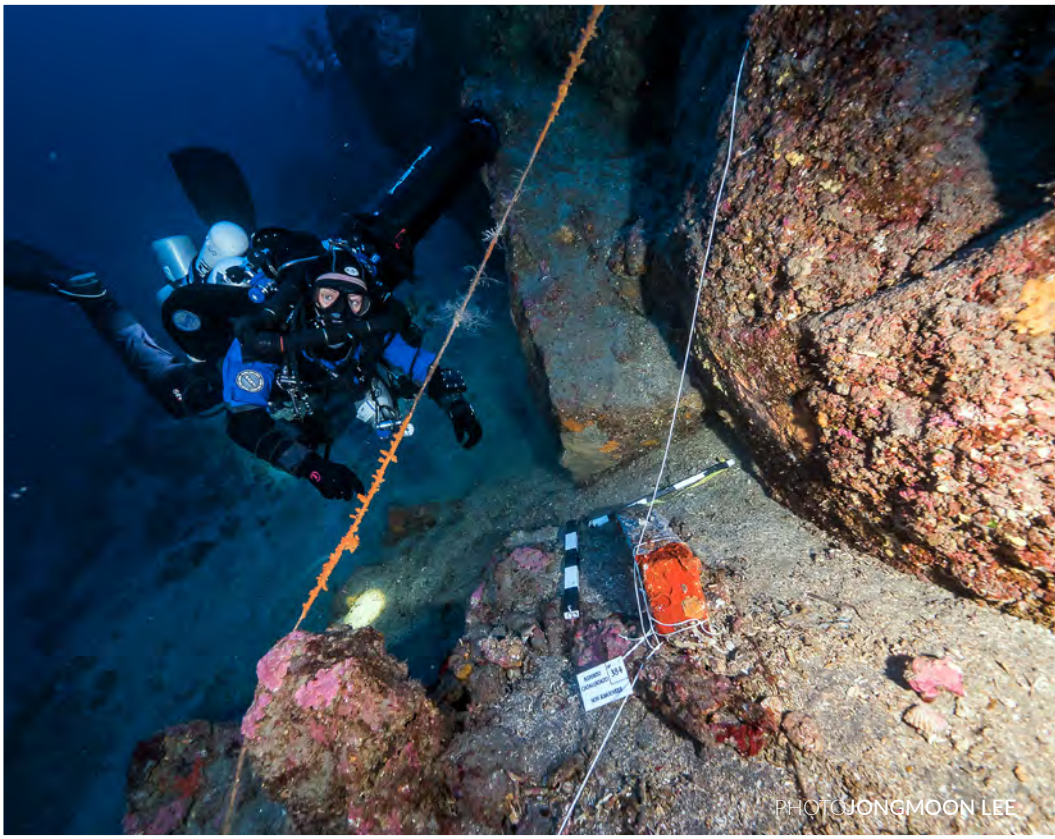
Archaeologists are now considering further investigation of the anchors, like isotopic analysis of metal samples, which would allow them to determine the number of years they have been submerged and to discover the origin of the lead with which they were built.

The project will continue in 2019 with a campaign scheduled for the month of June.

TEAM

Mario Arena, Chicco Spaggiari, Luca Palezza, Gideon Liew, JM Lee, Piero Labò, Federico De Gado, Pedro Mendonca, Ryan Booker, and Dorota Czerny

Divers surveying the artifacts on the bottom of the bay for the creation of an archaeological map



EXPLORING SICILY

Italian GUE divers Fabio Portella and Nicola Giusti have been busy exploring the eastern coast of Sicily.

A team of GUE divers, led by Fabio Portella of Capo Murro Diving Center, discovered the wreck of a US fighter aircraft off the Sicilian coast near Brucoli (Syracuse). The project was based on the testimony of elderly fishermen who, in July 1943, had seen a plane crash in front of the shore of Brucoli, near Augusta, during the Allied landing in Sicily (Operation Husky). The naval base of Augusta was an important target for the Allied aircrafts that departed from Malta and the bases in Tunisia and Algeria.

The plane lies about 60 m/197 ft deep on a muddy bottom in front of the mouth of a river, which makes the water extremely murky. The identification of the aircraft has been made difficult by the fact that the wreck is almost completely covered by mud and heavy trawl fishing nets. However, the discovery of a wheel and some structures have confirmed that it is a US fighter from World War II.

IL RELITTO DELLE BOMBE

Fabio Portella and Nicola Giusti have identified, off the coast of Syracuse, many wood boxes containing large-caliber bombs dating back to World War II. The discovery took place on a muddy bottom of 101 m/331 ft, thanks to a local fisherman's hint that says in that part of the sea there were so-called "relitto delle bombe" ("bombs wreck"). The origin of the bombs remains unknown. They could belong to a wreck still to be located, or they could have been intentionally discharged after the end of World War II, when ammunition that had been accumulated during the conflict was disposed of in the city's harbor.

THE AMPHORAE BARGE

Fabio Portella and Nicola Giusti have recently made a quite bizarre discovery. During an exploratory scooter dive on a muddy bottom at 57 m/187 ft, they identified a flat-bottom vessel that seems to be a small barge about 35 m/115 ft long and 15 m/49 ft wide. The strangeness is that the wreck rests upside down on a dozen ancient amphorae, both intact and broken.

Excluding the remote possibility of a "wreck on a wreck," the most likely scenario is that the barge was used after World War II during the enlargement of the old Syracuse port, and it sank with a mixed load of debris and amphorae excavated during such works.

A pile of naval artillery shells on the bottom of the sea

An ancient amphora and the WW2-era barge in the background

A wheel visible under the net-wrapped wreckage allowed divers to identify the discovery as a WW2 fighter plane.

BIKINI ATOLL – A TICKING TIME BOMB

The USS Lamson is one of the best dives in the lagoon, with lots of military hardware to explore.

PHOTO JESPER KJØLLER

Right after World War II, the Truman administration selected the Bikini Atoll in the Marshall Islands to conduct a series of tests to evaluate the A-bomb's impact on warships. More than 70 years later, the island paradise is slowly recovering from the nuclear impact only to be threatened by a new ticking time bomb.

In July 2018, a team of GUE CCR divers visited the remote area and investigated the possibilities of mitigating the environmental disaster that is bound to follow when the enormous vessels in the lagoon start leaking fuel. It is not a matter of if—it's a matter of when.

The radiation still presents a threat to life today, especially fishing and farming. However, as disturbing as this nuclear legacy might be, the radiation levels have decreased over time. Unfortunately, there is little we can do about the presence of the radiation; the damage is done.

The most acute threat is not known to the public, and it is serious. The sixteen shipwrecks that sank during the bomb tests were often filled to capacity with fuel, oil, and ammunition to get the most realistic experiment results.

The ships' structural integrity has been compromised over time due to corrosion and currents; time is running out and the environmental disaster will likely strike during this decade. The only responsible action is to do something as soon as possible.

The deterioration is most apparent on the mighty USS *Saratoga*, where the flight deck is collapsing, interior spaces with overheads are folding, and the superstructure has tilted and begun to collapse inward and to the port (left) side of the ship. The ships used as experimental subjects in Bikini Atoll are more than historic wrecks. They are large test instruments exposed to the effects of nuclear blasts, and the deterioration of the vessels is a long-term effect of the explosions.

ACCELERATED DETERIORATION

The natural processes of corrosion and deterioration inherent in all sunken vessels appear to be accelerated at Bikini. There are two theories currently being evaluated. The first is that the nuclear blasts introduced consistent micro-fractures throughout the steel structure of each ship, and this nuclear effect has resulted in a higher level of chloride absorption and subsequent accelerated corrosion, and that the steel is subject to larger-scale fracturing as it deteriorates. A second hypothesis is that the radiation from the two bursts converted elements in the steel into isotopes. The isotope of steel is said to have a half-life of seven years, and several generations of half-lives have further weakened the steel.

ACTION PLAN

The purpose of the expedition in July 2018 was to obtain first-hand knowledge of the environmental conditions, understand the complicated logistics involved in getting to and from the area, and to document the current state of the wrecks. After the nine-day expedition in the atoll, an action plan was formulated.

The proposed plan includes the following action items:

- The entire area should be surveyed in order to accurately position known and unknown objects. A digital elevation model (DEM) should be created, allowing the blast crater to be measured and the amount of displaced sediments calculated.
- The total amount of fuel and oil present in the shipwrecks at the time of sinking needs to be calculated and the environmental impact of a spill estimated.
- The current state of each wreck needs to be surveyed using photogrammetry and multibeam sonar technology to create high-resolution 3D and DEM models.
- The structural integrity of each shipwreck needs to be calculated using data about hull thickness, water temperature, water salinity, water conductivity, and hydrodynamic forces.
- Based on the level of priority, the 3D and DEM models created, along with the projected date of collapse, will assist the removal (oil tapping) of the fuel and oils contained within the shipwrecks.

We will continue work at the political level to get traction with the nations responsible for this environmental problem, primarily the USA and the Republic of Marshall Islands (MRI) and subsequently, UNESCO

Nagano *played a major role in the attack on Pearl Habor. The enormous Japaneese battleship was confiscated after the war and now rests in the lagoon in the Bikinis.*

and United Nations. The US government must be motivated to shoulder the responsibility and finance the surveys that will support the oil tapping that needs to take place. Otherwise, the international media will have a field day with images of tropical wildlife dying a slow and gruesome death covered in heavy fuel oil on white sandy beaches with coconut palms in the background. Getting ahead of this potential environmental disaster is particularly important since the catastrophe is preventable and cannot be considered an accident like the *Exxon Valdez* or Deepwater Horizon oil spills. The preventable nature of the potential catastrophe is the leverage we need to motivate the relevant government entities to take action.

TEAM

Richard Lundgren (Sweden); Jesper Kjøller (Denmark); Igor Siryk, Oleksiy Sverdlov, and Pavel Trofimov (Ukraine); and Martin McClellan and Richard Lewis (USA)

VIDEO

bit.ly/2WMI5Pf

PHOTOS **JESPER KJØLLER**

PHOTOS **JESPER KJØLLER**

❶ *The auxiliary steering wheel on USS* Lamson

❷ *Richard Lundgren discovers a US Navy diving helmet inside the USS* Saratoga

❸ *Planning is nessecary before the penetration dives on the enormous wrecks.*

❹ *The twin deck guns on the USS* Saratoga *are still pointing upwards.*

NORWAY

SECOND BATTLE OF NARVIK

During the Second Battle of Narvik on April 13, 1940, 11 Junkers Ju 52/3m airplanes landed on the ice of Lake Hartvikvatnet, 15 km/9 miles from Narvik's harbor, which was under attack by British naval forces. The German aircraft carried troops and gun supplies to support the battle. Due to mild weather, the ice had already begun to thaw. Fuel shortage, slush, and large puddles of water made it impossible for the Ju 52/3m airplanes to take off from the lake again. The German aircrafts were stuck.

The newly discovered Ju 52/3m rests at 70 meters.

PHOTOS **FABRIZIO TOSONI**

Only two of the Junkers, filled with fuel drained from the other stranded aircrafts, managed to take off from Lake Hartvikvatnet on April 17, 1940. On April 19, the Germans abandoned the lake. Attempts to save the nine remaining Junkers from sinking failed. All of the aircrafts sank to the bottom of the lake when the ice finally thawed.

After the war, a local scrap dealer and later on, Norwegian and German forces, found and recovered the wrecks of several aircrafts. At least five Ju 52/3m airplanes were recovered from 1983 to 1986, and today, they are exhibited in museums in Germany (Hannover, Dessau, and Speyer) and Norway (Gardermoen).

UNDISCOVERED AIRPLANE

Of the 11 airplanes, we disregarded the recovered wrecks, the two that managed to take off the icy lake in 1940, as well as the Ju 52/3m that lies in about 6 m/20 ft of water in good conditions and is a popular diving site. This left us with at least one undiscovered airplane; we assumed there must be at least one more Junkers on the bottom of Lake Hartvikvatnet.

We ran a one-week survey project from September 17–23, 2018, investigating Lake Hartvikvatnet with a sidescan sonar and a remotely operated vehicle (ROV). On the first day, we found an isolated wing and engine in the central part of the lake. On the third day, using sonar, we discovered a plane at around 70 m/230 ft.

SUCCESSFUL IDENTIFICATION

During the following days, we managed to perform several dives on the newly discovered Ju 52/3m. We were able to identify the construction number of the plane by the "Ace of Hearts" painting on either side of the cockpit. According to historical information found in the German book *Die letzten Junkers Flugzeuge* by Paul Zöller, the identification of this exemplary find is DB+RB with the serial number 6697.

In addition to this aircraft, we found several smaller Junkers pieces in Lake Hartvigvatnet, most likely the remains of previous salvaging operations.

The team plans to continue other similar research projects in Norway during the next season.

TEAM

Fabrizio Tosoni, Denise Tosoni, Peter Leopold, Christine Dybwad, David Pax, and Sakari Koskinen

SS CARTHAGE

Eceabat, Turkey (September 6-9, 2018) – A team of GUE divers, as part of a larger Turkish-German dive team, was tasked with a portion of the underwater videography and photography of the wreck of the French troop transporter *Carthage*.

The Gallipoli Campaign, one of the bloodiest battles of First World War, was largely unsuccessful for the Allied powers. The idea was, after the Ottoman Empire entered the war on the side of the Axis powers, to open up the seaway toward the Russian Empire, the Allies of France, and the British Empire. The invasion of the Gallipoli peninsula, which was supposed to happen quickly and easily after a naval attack and bombardment of the fortifications, halted in the very early stages, and after eight months of fighting, the land campaign was abandoned and the forces withdrawn. These battlefields saw more than 550,000 casualties. The lessons of this failed invasion were learned by the Allies, and the improved concepts helped secure the victory of the D-Day landing in Normandy in World War II. One of the victims of the opening battle at sea was the French ex-ocean liner, then troop transporter SS *Carthage*.

VIOLENT JOLT

The passenger-cargo steamer SS *Carthage* was launched in 1910 at Newcastle, England, and delivered to the French CGT shipping company in Marseille. She served the maritime lines between southern France and North Africa, mainly Tunis. In early 1915, she was requisitioned by the French government and used as an armed auxiliary cruiser to transport troops and supplies.

On June 30, 1915, the SS *Carthage* arrived with a large supply of ammunition for the French army at Cape Helles and started unloading her cargo by barges, while being at anchor.

On July 4, 1915, the SS *Carthage* was attacked from a distance of 800 meters by the submerged German submarine *U-21* under Captain Lieutenant Otto Hersing. "The torpedo hit the port side of *Carthage* near the machine room area.

The interior of the wreck with access to the engine room

The ship was shaken by a violent jolt and instantly began to sink fast with the aft first. Then she raised her bow up, almost vertically, and sank," reported French Captain Vecchioli.

GOOD CONDITION

She sank two nautical miles southwest of the entrance of the Dardanelles, in approximately 85 meters of water, with six crew casualties from a total of ninety-four complement.

More than 100 years after the sinking of the SS *Carthage*, the proud, 123-meter-long ship rests in an upright position, in one piece, in 85 meters of water on an even and sandy bottom, while her bow points to 290 degrees. The hull and almost all the parts of the vessel are in good condition. The vessel's wooden deck is partly destroyed but generally is well preserved. The two funnels and the masts have fallen down to the port side of the ship. Although the foredeck, the poop, and the superstructure are massively overgrown due to marine organisms, the construction and the most characteristic objects of the vessel (e.g., davits, chains, portholes, cabins, etc.) are clearly recognizable.

TURBULENT CURRENTS

Despite strong and turbulent currents, which interestingly changed directions depending on the depth, we were able to dive the ship and document the torpedo hole, as well as to film the interior with the beautiful staircases.

The video footage will be part of a planned documentary film for the Turkish channel BeIN IZ TV. JJ-CCR rebreathers in the GUE configuration were successfully used on all dives.

TEAM

D. Remmers (videographer), D. Galon (photographer), R. Wissel (lighting), M. Kerwath (lighting), and W. Mönnikes (surface support)

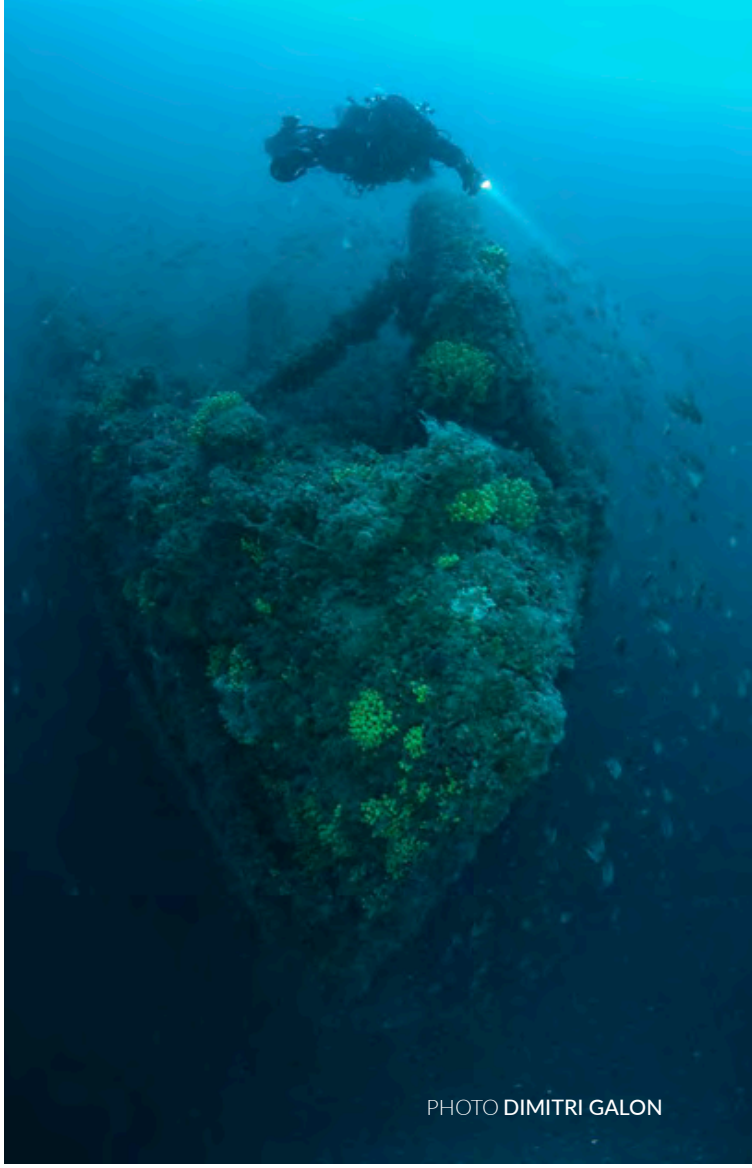
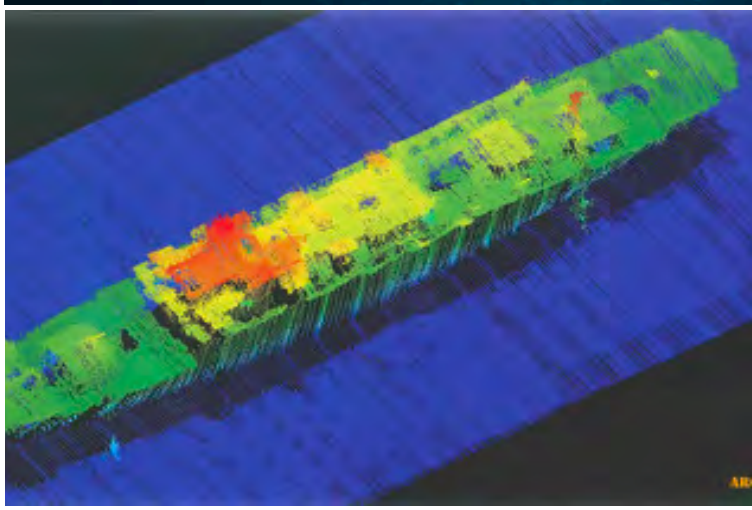


PHOTO **DIMITRI GALON**



Top to bottom:

The bow of SS Carthage

A sidescan sonar image of the 125-meter-long wreck

SS Carthage *at dock*

PRINCESS OF THE ORIENT

In 2017, during the GUE Egadi project, I met Karl Hurwood, owner of Pro-Tech Philippines. Karl was putting together a team of divers to dive the *Princess of the Orient* in early 2018 with the intent to document this mysterious wreck.

The Philippine-owned Sulpico Lines, who owned the *Princess of the Orient* at the time of her sinking, purchased the ship, then known as the *Sunflower 11* passenger ferry, from the Japanese-owned Nihon Kosoku Ferry Company in the early 1990s.

The original Japanese vessel, the *Sunflower 11*, was built in the style of a cruise ship and marketed as the most luxurious ferry in Japan. She was commissioned in September 1974 to run the popular Osaka to Kagoshima route. However, the oil crisis of the early 1970s led to a huge drop in tourism, which affected the Japanese ferry industry. She was sold, refitted, and modified prior to becoming the flagship of Sulpico Lines and sailing again as the *Princess of the Orient*.

IDEAL CONDITIONS

The *Princess of the Orient* project required experienced and capable divers with CCR training and mixed gas capabilities. This was exactly what I had been wanting to do for a number of years, and the opportunity finally presented itself.

Dive conditions were near ideal and the team managed to pull off three dives on the wreck at average depths of 112 m/367 ft, with the deepest being 128 m/420 ft. Bottom times were between 30 and 40 minutes with the associated decompression profiles. Total run time was around 250–295 minutes. The team managed to get some interesting video footage and photographs that provided a clearer picture of the overall condition of the wreck, which was intact with a minimal amount of marine growth and deterioration.

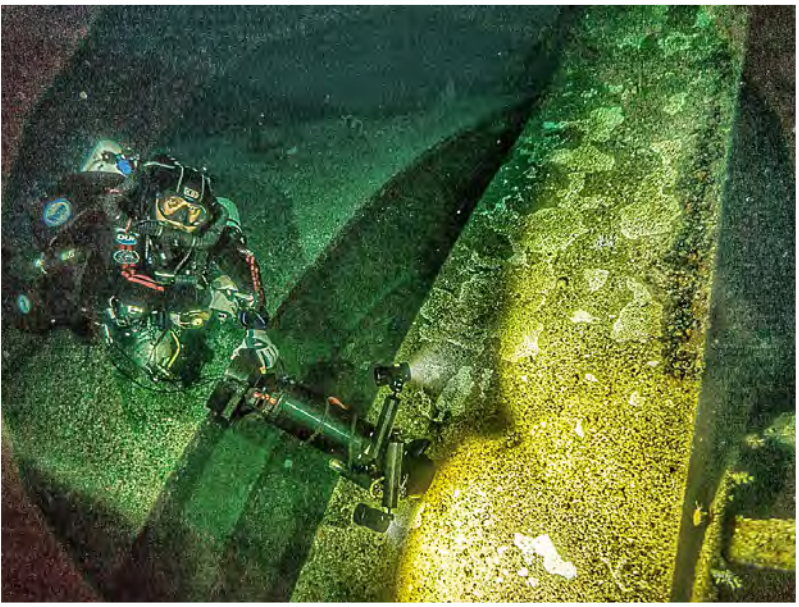
There are plans underway for a 2019 expedition, with the aim to carry out some penetration and some more extensive documentation involving video and photogrammetry techniques.

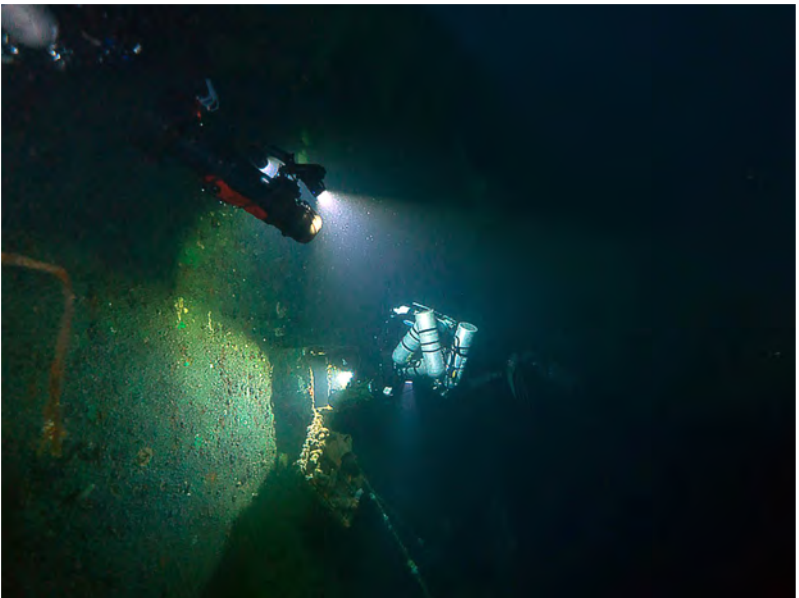
TEAM

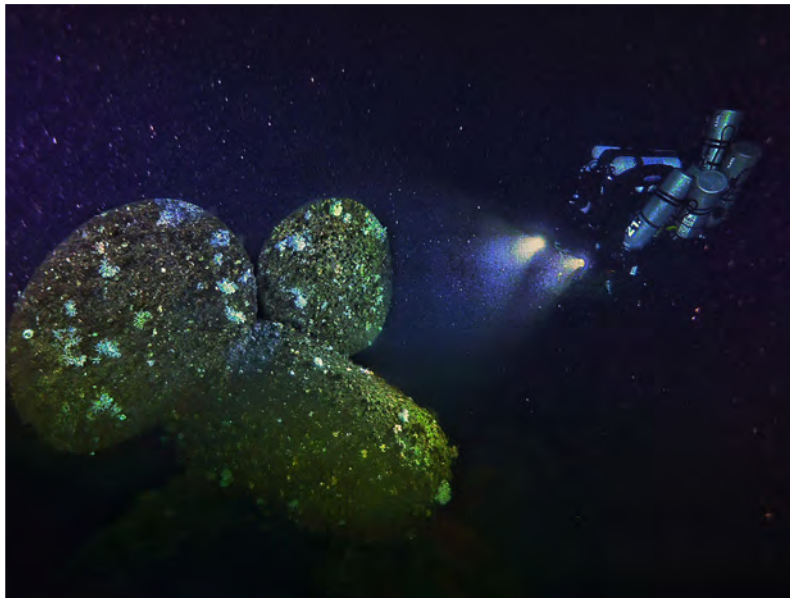
Karl Hurwood: project organizer and video diver, Miko Zulueta: project co-organizer and light diver, Ali Fikree: exploration and photography, Jin Hui: exploration, and Cui Wei: exploration

Divers exploring the gigantic wreck at 120 meters

PHOTOS **ALI FIKREE**







THE SHIP THAT CHANGED HISTORY

Eceabat, Turkey (September 1-9, 2018) – A team of GUE divers was tasked with a part of the underwater videography and photography for a production of three episodes for the Turkish documentary TV Channel BeIN IZ.

In 1993, at the bottom of the Aegean Sea, close to the Dardanelles, the shipwreck of the German light cruiser SMS *Breslau* was found. In terms of her historical significance, she is probably the most important existing historical shipwreck of the Eastern Mediterranean. In September 2018, equipped with a dive permit from the Turkish Ministry of Culture, a Turkish/Greek/German dive team succeeded in examining and documenting her, 100 years after her sinking.

The London Times wrote on January 22, 1918, two days after the loss of SMS *Breslau*: "Despite their nefarious career, no other two ships have had such a significant impact on the war as the *Goeben* and *Breslau*." Additionally, the First Lord of the Admiralty, Winston Churchill, confirmed this thesis with his statement that those two ships who forced the Ottoman Empire into the war "brought more slaughter, more misery, and more ruin than has ever before been borne within the compass of a ship."

LEGENDARY ESCAPE

The *Breslau*, a Magdeburg-class light cruiser with a length of 139 meters and a displacement of 4570 tons, was commissioned to the German Navy in 1912. After the outbreak of war, she served in the Mittelmeerdivision (Mediterranean division). In August 1914, she was part of the squadron who legendarily escaped through the Mediterranean, trying to avoid direct enemy contact with the British fleet. They succeeded in outsmarting their persecutors and reached the Strait of the Dardanelles where they found shelter in the then-neutral Ottoman Empire. Although the ships were turned over to the Ottoman Navy, the German crew largely stayed, and the German Admiral Souchon remained in command of them. The *Breslau* was renamed *Midilli*. She took part in bombardment against Sevastopol in September 1914, which eventually led the Ottoman Empire to enter the First World War on the Axis side.

In January 1918, the *Midilli* and the ex-*Goeben* were to attack British ships close the island of Imbros. After sinking two enemy ships, the *Midilli* steamed back but encountered a minefield, and subsequently was hit by five mines. The ship sank stern first, with only a small number of their crew being rescued by British ships.

TV DOCUMENTARY

Well-known Turkish diver and TV presenter Savas Karakas, together with renowned wreck researcher Selçuk Kolay and a Turkish, Greek, and German dive team, were the first civilian divers to dive the wreck of the *Midilli* after its finding in 1993.

One hundred years after the sinking of the *Midilli* in the Battle of Imbros, the dive team shot underwater video, which will be used in three 50-minute docu-

Divers on the wreck of SMS Breslau

PHOTO **DERK REMMERS**

mentary films by the Turkish TV station BeIN IZ. Photos were taken and used for the press coverage of the event.

The wreck lies in depths ranging from 60 to 75 m/197 to 246 ft. The aft section is badly damaged and partly collapsed, while the bow and the amidships sections remain in extremely good condition. The two masts of the cruiser are broken and lie on the port side, while the four funnel holes are partly visible and easily recognizable. The bridge, the wave breaker at the forecastle, the two anchors at the bow, and the davits amidships are conspicuous and in good condition. All the 15 cm naval guns of the vessel are still mounted in their towers and still conspicuous. From the four propellers of the vessel, only the two propellers on the starboard side are visible.

PLAQUE

As a sign of respect to this legendary ship and the great loss of life during her sinking, the team left a commemorative plaque for the 100 years of the sinking of the SMS *Breslau/Midilli* at the tower of the bow 15 cm naval gun.

The area is generally known for its strong currents. JJ-CCR rebreathers in the GUE configuration were successfully used on all dives.

TEAM

D. Remmers (videographer), D. Galon (photographer), R. Wissel (lighting), M. Kerwath (lighting), W. Mönnikes (surface support)

PHOTO **DERK REMMERS**

The team placed a memorial flower for the crew of the SMS Breslau *and all the victims of the Gallipoli Campaign at the Canakkale Martyrs Monument in Turkey.*

PBM MARINER

In December of 2017, members of GUE Seattle received an unexpected email from a Ph.D. candidate in nautical archaeology named Megan Lickliter-Mundon. She hoped to create a 3D model of the wreck of the PBM Mariner that had crashed near Seattle, Washington, and then display it in the Pima Air & Space Museum for the public.

While Megan had experience documenting aircraft in tropical water with good visibility, Lake Washington is notorious for poor visibility, cold temperatures, and negligible ambient light. It can be challenging enough to take a few decent pictures in our local conditions, but for this project to be a success, we would need to take thousands of perfectly-lit images to assemble a 3D model. We were more than happy to lend our underwater skills, and we set out to document the Mariner as a team in early 2018. Fortunately, Megan had already secured the necessary funding and approvals for the project to begin.

FAILED RECOVERY ATTEMPT

The US Navy made extensive use of flying boats (including the PBM Mariner) during World War II in the roles that helicopters fill today: anti-submarine warfare, search and rescue, and escort missions. While over 1,300 were built, there is only one known fully intact PBM Mariner in existence. This plane is owned by the Smithsonian National Air and Space Museum and is displayed by the Pima Air & Space Museum in Tucson, Arizona. Our PBM Mariner is in relatively good shape and rests upside-down in about 21 m/70 ft of water. The only significant damage is to the tail section, which was removed during a failed recovery attempt by the US Navy in 1996.

DOCUMENTATION DIVES

After an initial scouting dive, we decided to model the wreck in four pieces and join those pieces together in the post-processing stage. We chose the port and starboard wings, the fuselage, and the tail as our chunks. While small, the wings are complex because of their unique four-bladed propellers, which we anticipated would require many images to model. Getting photos of every side of each blade was critical, as the propellers are particularly recognizable parts of the wreck. The fuselage, though large, is structurally simple, and we were initially quite confident that it would be easy to model. Finally, we modeled the broken tail section, which includes some of the interior of the plane. Interior spaces are enormously challenging to model, as a large camera system is difficult to maneuver without disturbing silt.

We focused our first documentation dives on the fuselage. Although we had expected this piece of the wreck to be relatively easy to model, we weren't able to assemble anything significant after processing several dives worth of images. After careful examination of how Agisoft PhotoScan used the images, we determined that we weren't getting enough contrast on any horizontal surface to assemble anything useful. It was clear that the amount of silt that settled on the plane's horizontal surfaces was subtly obscuring details and reducing contrast.

Documentation in progress in Lake Washington

PHOTO **KATHRYN ARANT**

The contrast was so low on the hull that Agisoft PhotoScan could only place a handful of pictures and, therefore, couldn't create a 3D model.

METHODICAL APPROACH

We returned for our next photography dive equipped with the knowledge that our images would have to be near perfect to get a good model of the wreck fuselage. Our plan for the second attempt was to photograph the wreck from short range to maximize the contrast and minimize the effect of poor visibility on the images. In addition to being more methodical with our photogrammetry techniques, we suspected that our prior activity near the airplane might have reduced the amount of silt present on the surface of the hull.

Thanks to a more methodical approach and a more experienced team, our second attempt was successful. We were able to capture the sides of the wreck along with the gently curved hull, the plane's biggest horizontal surface. To our great pleasure, the PBM's distinctive hull and its ball turret were easily visible in the in-progress model. We ultimately made six total dives to complete the project. The museum now uses a tablet to display our model of the PBM BuNo 59172 next to the recovered tail section of the aircraft, which in turn is on display next to the only intact and restored PBM Mariner in the world.

The PBM Mariner project was a successful example of what can be achieved when people from a wide variety of public and private organizations collaborate with a common goal. We hope to continue documenting other historically significant wrecks in Lake Washington and look forward to possible collaborations with more GUE divers and other organizations as well.

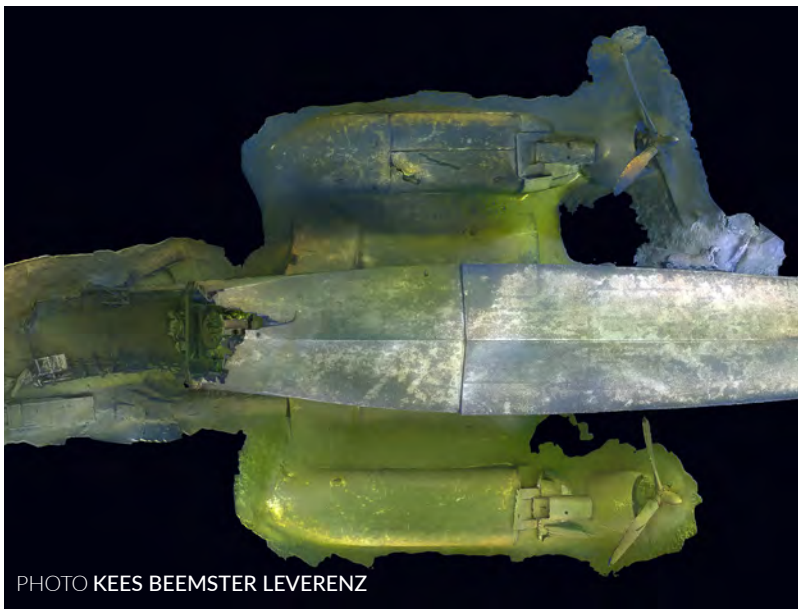


PHOTO **KEES BEEMSTER LEVERENZ**

3D model of the wreck

THE HIDDEN RIVER PROJECT

Since 2009, a team of experienced divers and GUE instructors has been exploring and documenting the so-called "Reseau de L'Ouysse" known as the cave diving sites Résurgence de Cabouy and Gouffre de Pou Meyssen in the department Lot in France. This year the team further documented and explored the cave and found some amazing new areas.

For the sixth year in a row, the team established a bivouac for multiple days in the massive air bell between the second and third sump of the cave. This required quite some logistics organization up front as well as a team with the necessary skills, experience, and equipment for safely crossing the first two sumps. Again, a support team helped to move the necessary equipment for seven team members who stayed overnight in the dry cave.

Based on our experience and preparation from past years, a cable car was again temporarily installed in order to move the dive equipment into the water at sump 3. Two divers conducted a dive in sump 3 and explored a possible air bell at about 3,600 m/11,811 ft that was found during a survey dive last year. The air bell turned out to be really huge (25 m/82 ft high by 18 m/59 ft long by 10 m/33 ft wide). At the northern end of the air bell, the divers found a clay hill where the cave moves on in another dry part. There is more to explore for next year.

Beyond the diving in sump 3 this year, a part of the team further explored and surveyed the southern passage of the dry section between sump 2 and sump 3, using single-rope technique, and found potential for further exploration.

Furthermore, the data from the two sensors in sump 1 and the new sensor in sump 3 was collected and analyzed; the water level at the entry of sump 3 varied up to 16 m/52 ft during the last year.

The Secchi disc that was installed in 2013 was moved closer to the entry of Résurgence de Cabouy in order to encourage more cave divers to take visibility measurements.

The current version of the map can be downloaded at *www.thehiddenriverproject.org/downloads/Reseau_de_lOuysse_plan.pdf*.

In 2019, the team of the Hidden River Project will continue to document and explore the Reseau de L'Ouysse.

For more information, videos, and pictures, please visit www.facebook.com/thehiddenriverproject/ or contact us at info@thehiddenriverproject.org.

TEAM

H. Amecke, D. Beiert, S. Bertelmann, I. Homberger, M. Isigkeit, J. Medenwaldt, M. Miethke, W. Mönnikes, K. Puchalska, U. Roschanski, R. Rosenberger, S. Schandelle, M. Schernbeck, S. Schlumbohm, T. Schnitter, and C. Schüle

Top to bottom:

2018 Hidden River team members

A team member at the bivouac air bell between sump 2 and 3

PHOTOS **ULI KUNZ**

PHOTO PETRA CLERX

PROJECT NUTTLAR

GUE Project Nuttlar is focused on exploring, surveying, and documenting a slate mine in Nuttlar, Sauerland, Mid-Germany. The mine is operated by Matthias Richter and his team from the dive shop Tauchschule Sorpesee, and was opened to certified cave divers in 2013. The project's survey map is supposed to work as a tool for those divers to plan their dives in the mine.

In April 2018, the team was back on track. Since the start in 2013, the survey map has reached quite a nice level of detail. Prior to the project, we identified a few remaining spots that needed to be surveyed in order to complete all main tunnels and connections of the mine. So, a team of two RB80 rebreather divers was sent to these more remote areas to collect the missing data.

With only one team of survey divers necessary, we were able to increase the efforts to collect data for a 3D model of the mine. This task was started as a little test in 2017, and the results looked quite promising. With several dive teams working on taking video and pictures of tunnels and items in the mine, a huge amount of data—many gigabytes—was collected.

AUTONOMOUS UNDERWATER VEHICLE

Besides the scuba diving related tasks, the project got another addition in 2018. Fabian Plum, a student of Hochschule Bremen, joined in to test the abilities of the ROV that he developed for his bachelor's thesis, "Development of an artificial neural network for controlling a biologically inspired soft robotic autonomous underwater vehicle". It is hoped that these ROVs can be a great addition as data collectors one day, especially in areas that are too small or too deep for divers. For the project team, Fabian even did a presentation one evening to explain the idea and mechanism of his ROV.

After the diving was done, the real work started: integrating the collected survey data into the map and feeding computers with the 3D data to build the model. All this non-diving work took a lot more time and effort than the dives themselves. Torsten Schnitter, our survey manager, completed the map. Finally, we have a survey map of the mine in Nuttlar, covering the whole system at all levels. Cave divers can now use it to plan their dives and navigate through the tunnels of the mine.

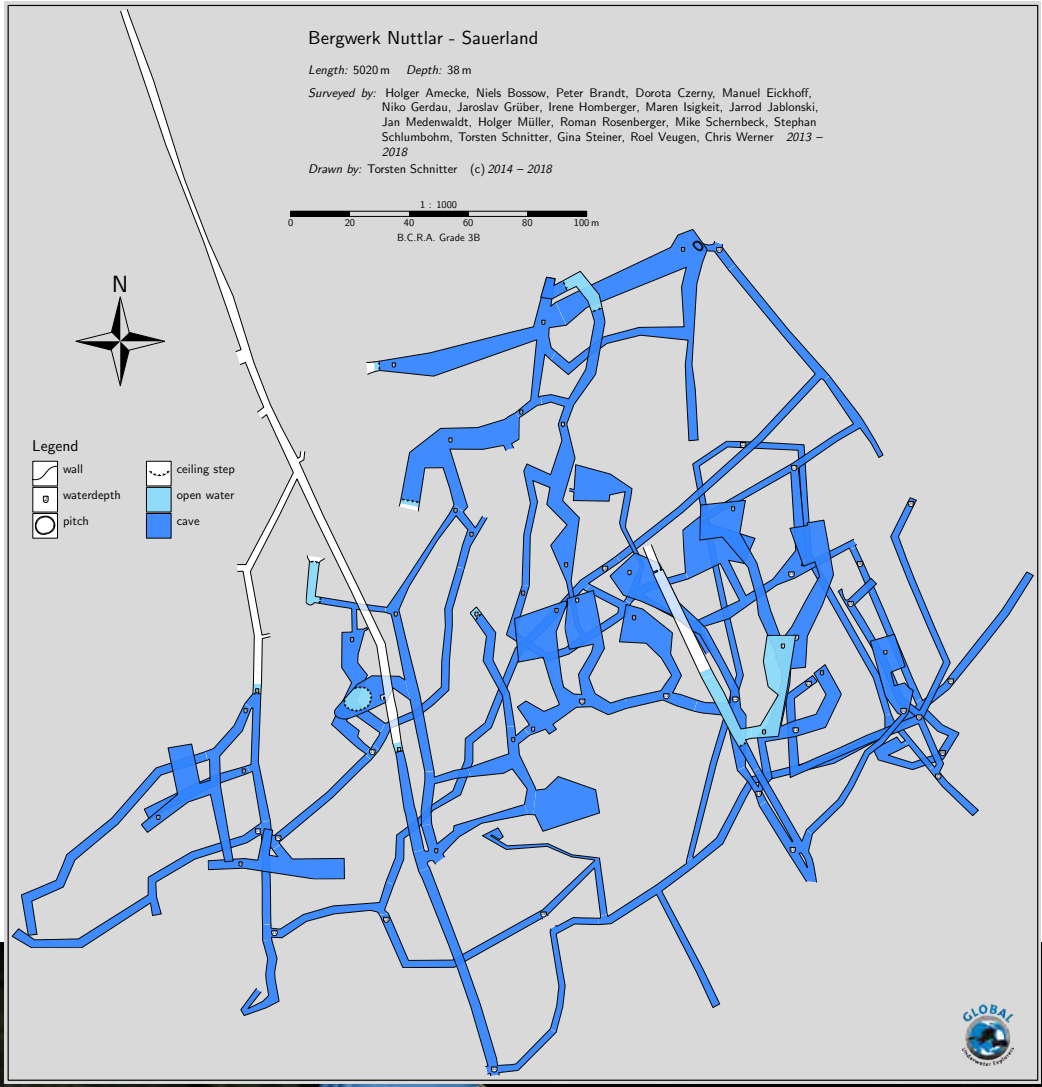
VIRTUAL DIVE

For the 3D model, Peter Brandt and Johan Wouters from Belgium are still feeding their computers with the data we collected in April 2018. For this task, processing capacity is the bottleneck, but the guys did an awesome job, and a first virtual dive into one of the tunnels of the system is already possible. We are looking forward to further results and to publishing them.

For further information about the project, please refer to *www.facebook.com/GUEProjectNuttlar.* The current versions of the completed map can be downloaded at www.bergwerktauchen.de/karten. Curious about the 3D model? Please like our Facebook page. We will publish news and links there.

TEAM

H. Amecke (camera), A. Bossow (logistics), N. Bossow (video light), P. Brandt (photogrammetry), M. Eickhoff (logistics), J. Hoffmann (camera), M. Isigkeit (coordinator, video light), S. Labisch (video light, science), P. Clerx (surface camera), S. Matthies (camera), J. Medenwaldt (survey), F. Plum (science), S. Schlumbohm (survey), M. Schernbeck (video light), and J. Wouters (photogrammetry)



Fabian Plum and his SAUV

PHOTO **PETRA CLERX**

CALA GONONE

An international team of GUE divers ran a two-week operation on the coastline of Sardinia, in collaboration with the researchers of ISPRA and Sapienza University of Rome.

The area of interest is located in the Gulf of Orosei, where some major springs bring the water of the inland aquifer from the plateau of Supramonte to the waters of the Mediterranean Sea. There are hundreds of caverns on the coastline and at least five massive systems where conditions are ideal for research and documentation of geological and paleontological aspects. These systems, once dry, not only present ancient speleothems, halocline, hydrogen sulphide, and branching passages that hide fossilized bones of extinct animals, but they may also be included in a marine protected area in the near future.

The original project in 2013 opened up multiple opportunities for collaboration with research institutes and universities; nowadays we are carrying out a five-year campaign dedicated to analysis of benthic foraminifera, small organisms that usually live in marine and transitional sediments, to recognize distinct ecological zones in these caves as well as their behavior in extreme environments. Initially the project focused on two caves (Bel Torrente and Bue Marino), but we extended the research to the other systems (Utopia in 2018; Cala Luna planned in 2019).

FOSSILIZED BONES

The project is also devoted to documenting conditions and the position of the fossilized bones found in the Bel Torrente cave, with photogrammetry and photomosaic techniques. Current theories propose that their position (quite far from the entrance) stems from a different origin, due to the freshwater input from the inland aquifer during rainy periods. Interestingly enough, there is still no found connection between the massive freshwater aquifer under the Supramonte plateau and the coastal caves, even though it has been proven with dye tracing testing.

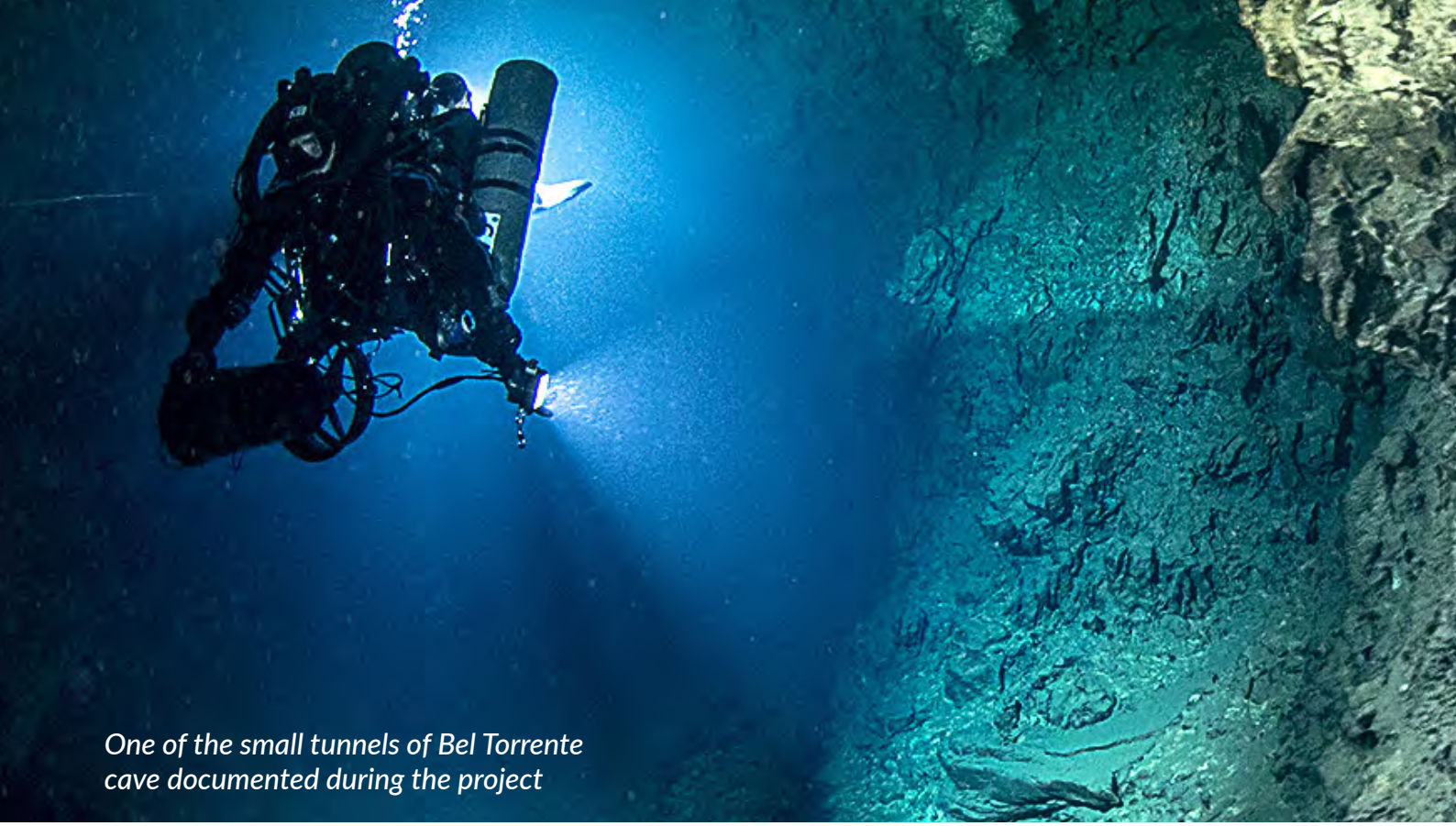
In 2018, the project ran operations that involved 40 GUE divers and local volunteers, who accomplished the collection of water and sediment samples; survey, photo, and video documentation; general scouting of the caves to gain a better understanding of the systems; and exploration of the surface area to evaluate possible connections between dry and flooded cave passages.

SERIOUS EFFORT

In 2019, the project will run multiple sessions in order to collect the detailed survey data required by researchers to georeference stations, both for Project Baseline as well as for sampling purposes. This will be a serious effort—working again on the paleontological aspects, creating better digital models of the bones and their position in the caves, creating an updated situation, and evaluating both surge and atrophic impact.

The main tunnel of Utopia cave characterized using benthic foraminifera

PHOTO **CLAUDIO PROVENZANI**



One of the small tunnels of Bel Torrente cave documented during the project

All GUE divers are welcome to join the project: andreamarassich@me.com

We would like to acknowledge and thank everyone who contributed to these achievements in 2018.

TEAM

Alvaro Aguilera, Andrea D'Ambrosi, Andrea Marassich, Antonio Petruss, Alexander Simons, Belen Andres, Benjamin Ott, Claudio Provenzani, Diego Aldegani, Dino Soru, Elena Romano, Federico De Gado, Gregoire Markesis, Irene Homberger, Igor Syrik, Jan Medenwalt, Jonas Fietz, John Kendall, JP Bresser, Katia Zoncato, Koenrad Van Schuylenbergh, Matej Korsic, Michael Spahn, Marcello Iacca, Marco Selvini, Mike Schernbeck, Peter Lawrenz, Pavel Trofimov, Richard Kingfelt, Ricardo Constantino, Roberto Costa, Simone Iaria, Sven Nelles, Stefano Gualtieri, and Umberto Musto

As a result of the campaigns completed so far, Dr. Elena Romano published scientific papers and presented the outcomes in multiple congresses:

SCIENTIFIC PAPERS

Bergamin L., Marassich A., Provenzani C., Romano E., 2018. Foraminiferal ecozones in two submarine caves in the Orosei Gulf (Sardinia, Italy). Rendiconti Lincei, DOI: 0.1007/s12210-018-0700-0 - IF 0.693.

Romano E., Bergamin L., Pierfranceschi G., Provenzani C., Marassich A., 2018. The environmental characterization of Bel Torrente submarine cave (Sardinia, Italy) using benthic foraminifera, 2017. Marine Environmental Research, 133, 114-127 - IF 3.344.

Congresses

Romano E., Bergamin L., Di Bella L., Frezza V., Marassich A., Provenzani C., 2018. Benthic foraminifera as proxies of environmental variability in the Orosei submarine cave system (Sardinia, Italy). FORAMS 2018. Edinburgh (UK), 17-22 June 2018.

Romano E., Bergamin L., Marassich A., Mo G., Provenzani C., 2018. Scientific diving for the study of Mediterranean cave environments: from protists to mammals. 4th European Conference on Scientific Diving. Orkney islands (UK), 9-12 April 2018 – paper in submission Special Issue of the international journal Aquatic Conservation – Marine and Freshwater

Ecosystems.

Bergamin L., Marassich A., Provenzani C., Romano E., 2017. Foraminiferal ecozones in two submarine caves in the Orosei Gulf (Sardinia, Italy). Accademia dei Lincei – XXX Giornata dell'Ambiente. Convegno "Cambiamenti e crisi nel Mediterraneo." Roma, 17 Ottobre 2017.

Romano E., Bergamin L., Pierfranceschi G., Berto D., Provenzani C., Marassich A., 2015. The environmental characterization in Bue Marino cave (Sardinia, Italy) using benthic foraminifera. International Congress "GeoSUB – Underwater geology." Trieste, October 13-14, 2015.

Mo G., Provenzani C., Marassich A., Romano E., 2015.


PHOTO ANDREA MARASSICH

Characterization of Mediterranean monk seal (*Monachus monachus*) bones in Bel Torrente cave (Sardinia, Italy). International Congress "GeoSUB – Underwater geology" – Trieste, 13-14 October 2015 - paper in submission for publication.

Bergamin L., Romano E., Celia Magno M., Berto D., Provenzani C., Marassich A., 2015. The environmental characterization in Bue Marino cave (Sardinia, Italy) using benthic foraminifera. International Congress "GeoSUB – Underwater geology" – Trieste, 13-14 October 2015.


PHOTO CLAUDIO PROVENZANI


PHOTO CLAUDIO PROVENZANI

Sampling sediments in Bel Torrente cave to determine the presence of environmental indicators (top) and documentation of monk seal bones (left)

OLIERO CAVE SURVEY

The Oliero Cave System in Valstagna, Italy, is a well-known cave system that has been the site of multiple projects related to exploration and survey and is actually still an ongoing exploration effort.

There are two separate entrances, Covol dei Siori and Covol dei Veci, that connect before getting to sump 1at around 2.5 km/8,200 ft of penetration from the entrance. There are multiple connections between Siori and Veci, as the two branches run closer and closer to each other. About four years ago, a new connection was discovered only 600 m/1,969 ft from the entrances of Veci and Siori. The water temperature is about 8 degrees Celsius, and the average depth is 42-45 m/138-148 ft, with a maximum depth of 57 m/157 ft

In December 2018, thanks to finally improved cave conditions, we decided to map the deep part of the two branches of the cave, including the first bypass. Admittedly, it is unfortunate that currently there is no complete and published survey of the system, or at least of the part that has already been explored.

BROKEN LINE

Historically, the main difficulties involved in the survey of this cave have been caused by the conditions of the line. As in many European caves, the line is often broken during winter floods and needs to be replaced during the following season. In most cases, this is done without a proper cleanup of the previous lines, which causes a pretty confusing situation with a number of broken and partially loose lines.

After georeferencing the entrances, we started laying a new main line because the thickness of the existing one was not compatible with the use of the new cave surveying tool, MNemo, which was vital for the data gathering process. MNemo is so efficient that it can be considered revolutionary in making the process much faster and more precise. As divers swim along, MNemo records the length of the line as well as the depth/tilt angle at the starting point and at the end. These data then get transmitted via USB to a computer to be integrated into mapping software. During eight relatively extended dives, which involved PSCRs with multiple stages and DPVs, we were able to map 1,600 m/5,250 ft of the cave.

JOIN THE PROJECT

In January, Giovanni Marzari, Antonio Tedesco, and Matteo Ratto joined our team and have been a great help. Our goal is to keep mapping the system as far as we possibly can. The survey project is open, and anyone who would like to contribute and be part of it can simply contact us at stefano@stefanogualtieri.com or diego.aldegani@gmail.com.

Cool dei veci cave entrance (top)

A diver surveying the system with the MNemo (right)

A temporary map of the system; the team plans to extend the survey during 2019. (bottom)

BRITISH COLUMBIA

It has been a productive year for GUE British Columbia's Project Baseline initiatives. Our projects are located on both Vancouver Island and Vancouver mainland areas.

On Vancouver Island, Project Baseline Saanich Inlet continues to generate regular and consistent readings at the McKenzie Bight and Henderson Point sites. With this platform in place, we have integrated photogrammetry at both the sites. Most recently, at the McKenzie Bight Site, team members Ewan Anderson and Jim Dixon created a complete terrestrial model of the valley where the sponges are located—you can now virtually visit the site via Sketchfab. This work built on the efforts of Joakim Hjelm and myself. Over a year ago we decided to use photogrammetry to document the sponges individually to monitor health, and we have been happy with the results. We feel this is an excellent supplement to the photos gathered during regular readings. Similarly, we have employed the same techniques at the Henderson Point site to document the degradation of a wreck, a joint effort from Joakim and Ewan spanning from 2015 to 2018. In most recent news, we have added another sponge to the McKenzie Bight site (picture included) and added a locating line from the sponges toward the shore to aid in navigation.

CLEAN UP

Our community outreach initiative, Durrance Lake Cleanup, is in its third year now. Teams have removed close to a ton of debris, and turnout for this event continues to grow. This project is in collaboration with local environmental governing body Capital Regional District. This year's event saw 20 volunteers, 15 of which were local GUE divers. Similarly, our teams regularly remove ghost crab and prawn traps from the Saanich Inlet. This has become a bit of a pastime. Food and beverages for volunteers this year were paid for using revenue created through the sale of recovered traps, thanks to team member Lee Critchley.

TEMPERATURE SENSORS

The future is bright as we hold steady on regular readings and continue to develop our photogrammetry skills for more challenging projects in the future. We have had our eye on Canadian destroyers HMS *Saskatchewan* and *Cape Breton* off the coast of Nanaimo (Vancouver Island) for quite some time. This would be a pinnacle endeavor and a great challenge for our teams, and it remains a strong aspiration for the future.

In the Vancouver, BC area, Vladimir Chernavsky put a great deal of time and energy into building underwater temperature sensors. The sensors have been used to great effect at Britannia Beach. Their temperature data is directly visible in the Baseline database. One of the sensors was deployed successfully for half a year in the Nomash River Cave on Vancouver Island. Future aspirations for a Nomash River Cave Project Baseline station are in the works. Another exciting development is greater access to the Sponge Bioherms in Howe Sound with the installation of a permanent

Station 3, the newest sponge to be monitored at the McKenzie Bight PB site in the Saanich Inlet project area

PHOTO **CHRISTOPHER LOCKER**

mooring line. There is a great opportunity to deploy a Project Baseline station here, and a great opportunity to collaborate with several other citizen science organizations, the Underwater Council of BC, the Marine Life Sanctuaries Society, and the Vancouver Aquarium. We would like to integrate photogrammetry into our mainland projects (Vancouver area). The next step is to get that happening. It's going to be an exciting coming year!

TEAM

Christopher Locker, PB manager, Vancouver Island, BC
Anton North, PB manager, Vancouver, BC

Durrance Lake Cleanup volunteers and Capital Regional District (CRD) staff members

PHOTO **JOAKIM HJELM**

ABU TALHA AND THE CANYONS OF DAHAB

Ten divers from six different countries joined at Scuba Seekers in Dahab for a new Project Baseline project. The starting point for most of the team members was only a location and stories about an amazing canyon.

The Sinai Peninsula is an Egyptian land area of about 60,000 km²/23,000 mi² and the only part of Egypt located in Asia. Triangle-shaped, its boundaries are the Mediterranean Sea, the canal and Gulf of Suez, and the Gulf of Aqaba.

Sinai is linked to the African continent by the Isthmus of Suez, a 125 km/78 mi wide strip of land containing the Suez Canal, and linked to the Asian mainland by the eastern Isthmus, a land strip around 200 km/120 mi wide.

TECTONIC PLATE ACTIVITY IN THE RED SEA

The Gulf of Aqaba is a site of major tectonic plate activity. The Sinai Peninsula's eastern shore separates the Arabian plate from the African plate. The Red Sea is an example of a divergent boundary, i.e., when two plates slide apart from each other.

DAHAB AND ITS DIVE SITES

Dahab is a small town on the southeast coast of the Sinai Peninsula, approximately 80 km/50 mi northeast of Sharm el-Sheikh. Formerly a Bedouin fishing village, Dahab is now considered to be one of Sinai's most popular diving destinations. The Desert Mountains enter abruptly in the sea, quickly reaching depths beyond recreational diving.

Numerous underwater canyons may be found, some of which are parallel and others perpendicular to the coast line.

ABU TALHA

Also called the hidden canyon, the Abu Talha canyon is not a popular recreational dive site because of its depth (50 m/164 ft). Nevertheless, it is noticeable because of its length and beauty.

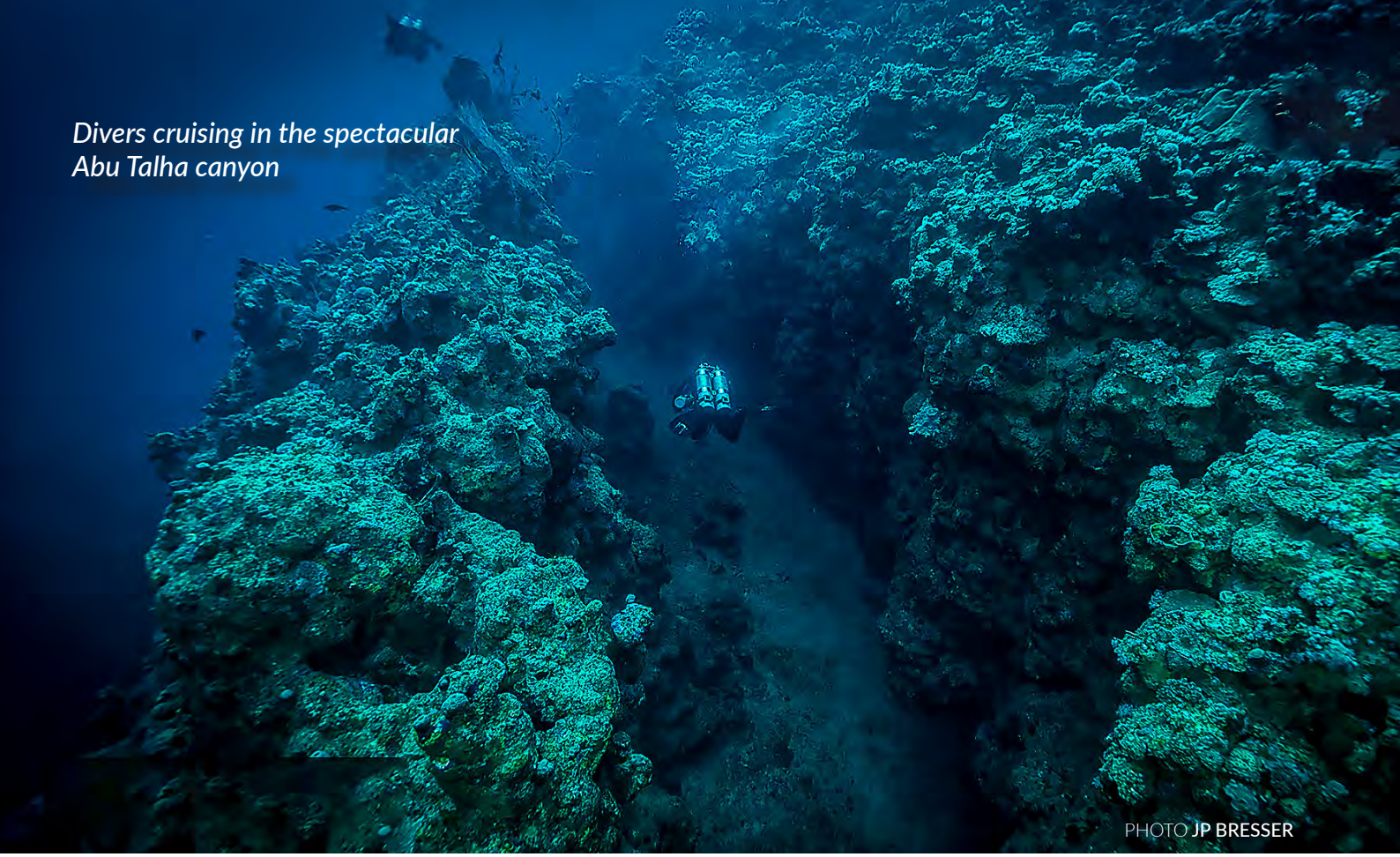
The team set out to describe the Abu Talha canyon landscape in a reproducible manner (to be regularly monitored), but also to look for evidence that may give indications on its origin (coral, tectonic, other) and to assess marine life (e.g., is there human impact?).

METHODS

Diving took place over three days. The first day we went by boat, as the tide was not favorable for a dive from shore. The other days we swam about 10-12 minutes from shore from a carefully selected access point from the beach.

The canyon is thought to be about 1,500 m/4,920 ft long, so the team set out to map and measured approximately the first 100 m/330 ft of the canyon. Additionally, we covered some remarkable features between the canyon and the reef, which is a very nice place for deco stops. Depths vary from 42 to 55 m/140 to 180 ft. Lots of pictures and video were taken to create a 3D model from this amazing canyon.

There were multiple recognizable landmarks, which made it difficult for one team to measure from A to B and another team from B to C. With the



Divers cruising in the spectacular Abu Talha canyon

PHOTO JP BRESSER

help of videos taken by the team, we were able to combine our drawings and create the map. Therefore, one of the big lessons for the next phase of the project is to place artificial markers.

DIVE EQUIPMENT

10 x GUE standard configuration
10 x double 12 L tanks filled with trimix 21/35 or 18/45 (back gas)
10 x single 12 L tanks (S80) filled with nitrox 32 & nitrox 50 (deco gas)
2 x single 7 L tanks (S40) filled with oxygen (deco gas)
10 S80 deco & 2 S40 O_2 deco
2 DPVs
Video & photo equipment
GPS from camera
1 x underwater measuring tool

LOGISTICS

Provided by Scuba Seekers diving facility & filling station
3 x four-wheel-drive pickup trucks
1 boat

SOFTWARE

3D modeling software
Video editing software
Mapping software

RESULTS

The team made a 3D model and a map from the first part of the canyon. There is also a video to document the project, which can be found at:
vimeo.com/315403908

TEAM

Sameh Sokar, JP Bresser, Peter Barbot, Charles Honore, Arthur Lee, Maikel Wagemans, Salem Saleh, Faisal Al-Qahtani, Ebrasho Muhammad, and Simone Russchen

A big thank you to the staff of Scuba Seekers who took care of all the logistics.

The team after a survey dive

Working on a photo/video session is demanding but also satisfying for both photographers and the models.

PHOTOS **PETER GAERTNER**

There is always a director involved to supervise and ensure models, equipment, and the general scene is set up as planned.

There is time for loads of fun, experimentation, and inspiration—underwater you are never in control of the environment, which makes the whole project more exciting.

PHOTO HUNTING – SHARKS INCLUDED

In the third week of October, a dedicated group of GUE divers volunteered their time and talents to help GUE by shooting photos in Egypt while visiting the beautiful and spectacular Brothers Islands, Safaga, and the Hurghada area.

The main target was to shoot underwater recreational images and video as well as topside (on land) photos and videos, both for educational student materials and for multiple educational film projects.

There was a mix of experience levels on board (four GUE instructors, plus cave and tech divers), but one of the guests was a newly certified GUE recreational diver, who was diving for the first time from a liveaboard and in conditions offered by the Red Sea.

The outcome was hundreds of photos, hours of underwater and surface video footage, and great plans for at least three educational/promotional GUE videos.

This was the second edition of the photo/video GUE trip with a third one planned October 10-17, 2019.

TEAM

Nigar Asadova, Manuela Schoch, Peter Gaertner, Julian Muehlenhaus, Dimitris Fifis, Sameh Sokar, Mostafa El-Damaty, Amgad Ibrahim, and Olga Martinelli

GHOST FISHING MISSIONS

It was an unforgettable experience for the divers, volunteers, and friends who were part of the Healthy Seas #SaveYourBreath event organized in collaboration with Ghost Fishing and Cousteau Divers. Whether they were above or under the water, each of the 30 some people included in the team had a special role to carry out.

Organizing a big live streaming educational event on one of the most popular islands in the world is no easy task. Three months of vigorous preparation went into planning every single detail. And yet, when the team arrived in Santorini, there was still lots more to figure out.

Like, finding the right boats. Or, how will the server streaming the live feed be powered? With only two days to go until the big event on June 8th, some of us were busy with building the equipment while at the same time others were running up and down the island to find a power source that could handle the demand on a RHIB. In the end, we used a construction with three big boat batteries!

The divers, on the other hand, were challenged by the steep underwater cliffs that were formed thousands of years ago when the Thera volcano erupted. Pascal van Erp, founder of Ghost Fishing, spearheaded the ghost net removal operation. He described underwater Santorini as a giant lagoon with very steep drop-offs which rapidly reaches 400 m/1300 ft of depth and which would require good teamwork to get the net safely out of the water. Thankfully, the diving team had worked together many times before and was able to remove a huge ghost net measuring approximately 150 m/492 ft from depths of 20-40 m/65-130 ft.

After the nets were removed from the seabed, they were securely placed into large bags and will be transported for regeneration.

TEAM

Pascal van Erp, Ben Oortwijn, Pierre-Yves Cousteau, Nikos Karatzas, Areti Kominou, Giorgos Kolikis, Apostolos Stylianopoulos, Omar Almukhtar, Noémie Stroh

SUPPORT TEAM

Veronika Mikos, Jenny Ioannou, Marta Fortes Vilaltella, George Papaspyrou, Artemis Samothrakis, Brad Bazemore, Brendan Walters

DIVE CENTER

Atlantis Diving

SPONSORS

Carvico Spa, Seascape Subsea Technology, Nanocosmos

VIDEOS

vimeo.com/278629287
vimeo.com/274738203

PHOTO **ARETI KOMINOU**

Diver Nikos Karatzas preparing a lost fishing net for lifting in the Santorini caldera

The whole Santorini project team

PHOTO **THODORIS TRIGKAS**

The fishing net is lifted in one piece from the Santorini caldera, ready to be taken onboard the fishing vessel.

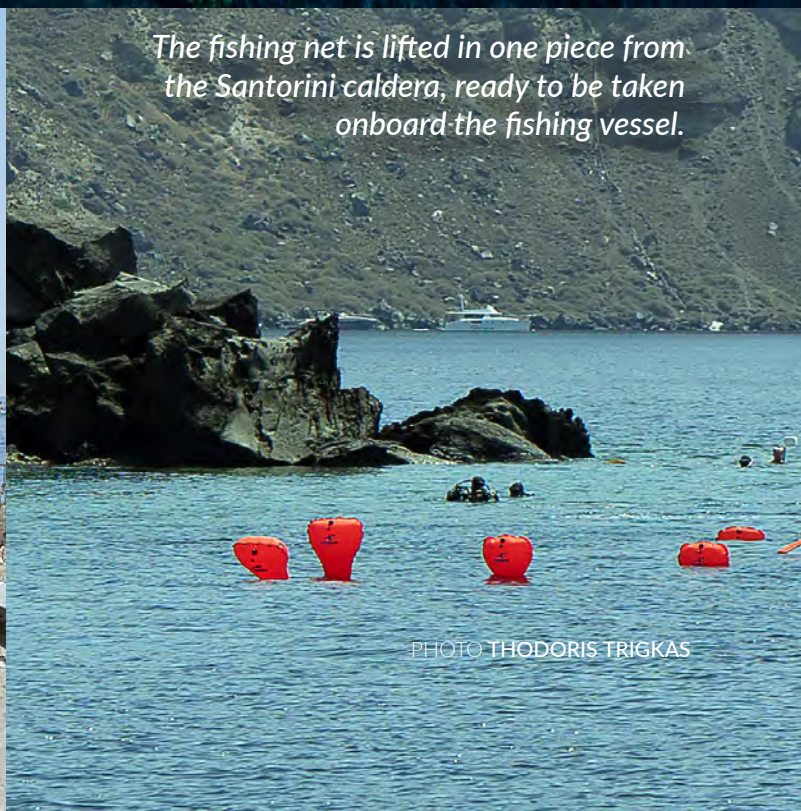


PHOTO **THODORIS TRIGKAS**

OPERATION STONE & POTS

Fify-seven lost lobster pots pulled out from the seabed in Galway.

September 3-6, 2018. Supported by Gesellschaft zur Rettung der Delphine (GRD) and Scubadive West, we carried out a first of its kind ghost fishing gear removal operation (Operation "Stone & Pots") off the W. Coast of Ireland.

During operation "Stone and Pots", our team of six expert technical divers, joined by cameramen and biologists, recovered 57 lost lobster pots, hundreds of meters of rope, and several fishing nets from the bottom of the Killary Fjord in Co. Galway.

Lobster pots are accidentally lost when their surface marker buoys get severed during storms or collision with boat traffic, and they unfortunately continue to fish when left unattended on the seabed. Much marine life was found dead in these traps, although some lucky crabs, lobsters, conger eels, and dogfish (a small shark species) were saved by the divers who released them just in time.

The retrieved lobster pots were taken on board a mussel boat and offloaded in the local fishing harbor, Rosroe Pier, where they were returned to the fishermen to use them once more. The locations of some of the pots were known to us, as we had recorded their coordinates during a survey mission in May 2018, but most pots were found at previously undived locations and were alarmingly easy to find; the seabed is littered with them, and many more remain in situ to this day.

On September 5th, the Galway Aquarium hosted a presentation to introduce Ghost Fishing and GRD to the Irish public while the next day, our divers joined a beach cleanup in Grattan, Salthill, organized by the Aquarium and Clean Coasts. Both side events were well attended and provided a good opportunity for the locals to learn about our work.

We aim to return to Ireland next year and intend to establish a permanent chapter there. If you are an experienced technical diver and would like to be part of the Ghost Fishing Ireland chapter, we hope to hear from you!

TEAM

Bas Poelmann, Marcel Kersten, Mick Knippers, Martijn Hessels, Rob Post, Ad Groenenberg, Sarah Tallon

DIVE CENTER

Scubadive West

SUPPORT TEAM

Birgit Ischner, Jenny Ioannou, Pascal van Erp

SPONSORS

Gesellschaft zur Rettung der Delphine (GRD), Dapper Tattoo

VIDEO

vimeo.com/307253932

PHOTO **GRD**

PHOTO **SARAH TALLON**

Diving team working on a survey of lost fishing gear (top)

Diver Martijn Hessels preparing a crab cage for lifting (left)

Divers Bas Poelmann, Martijn Hessels, and Rob Post (bottom)

PHOTO **BIRGIT ISCHNER**

AEOLIAN GHOST NETS

Monster ghost net recovered by divers off the coast of the Aeolian Islands.

Divers Pascal van Erp and Pim Jonker preparing the huge fish farming net for the last stage of lifting to surface

Pascal van Erp, Jasper Algra (divers), Tanino (photographer), and Bas Poelmann (diver)

MISSION AEOLIANS 2018

From October 6-8, 2018, an amazing team of Dutch and Italian Ghost Fishing volunteer divers carried out a ghost net recovery mission off the coast of the Aeolian Islands in Italy. It was organised by Healthy Seas in cooperation with the Aeolian Islands Preservation Fund and Blue Marine Foundation.

Pursuing a tip from the locals, our goal was an enormous fish farm net at 33 meters of depth, which was apparently blown out to sea 10 years ago when a big storm hit the island. Over the first two days we performed some preparation dives to assist in the recovery of what ended up being the biggest one in Ghost Fishing's history! The last day we spent some extra time to execute a local harbor cleanup to remove a massive amount of dumped long lines. The net weighed almost 3 tons while the long lines weighed another ton, a total of 4 tons in just three days. With help from local fishermen and the Coast Guard, and while using only our hands and no machinery, the monster ghost net was brought to surface on October 8th, 2018.

The net was surprisingly clean and very suitable for regeneration.

For 2019 we have plans to continue the harbor cleanup with local diving center involvement. This will be an intensive project in itself.

DIVING TEAM

Pascal van Erp, Bas Poelmann, Pim Jonker, Jasper Algra

SUPPORT DIVERS

Carmelo Isgro

SUPPORT TEAM

Veronika Mikos, Ambra Messina, Jenny Ioannou, Coast Guard of Lipari

DIVE CENTERS

Lipari Diving
La Gorgonia Diving Centre Saracen Diving

SPONSOR

Aquafil Spa

VIDEO

vimeo.com/303063984

The final stage of lifting just before pulling the fishing net onboard the fishing vessel

PHOTO **L'OCCHIO DI SALINA**


PHOTO **CARMELO ISGRÒ**

DENDROPHYLLIA RAMEA PROJECT

During 2018, Big Blue Xplorers, a GUE affiliate, joined a scientific project to acquire new information about the biology of *Dendrophyllia ramea*, a protected species of conservation interest in its native range (the coral species is included in the IUCN Red List and Annex B of the Barcelona convention) that is not well-studied and oftentimes difficult to find.

The large coral, characterized by an orange-yellow arborescent skeleton with large white polyps, is present in the Mediterranean Sea and is generally found at greater depths in the southern part of the Mediterranean basin.

The project started thanks to the identification of a site with many colonies of *Dendrophyllia ramea* in 85 m/279 ft of water off the coast of Syracuse (Sicilia, Italy). This finding interested researchers who jumped at the opportunity to closely study their ecology. Bluere-search, our partner in this project, provided the technology necessary to collect data useful for defining the daily rhythms of the corals' activity (e.g., feeding, reproduction), which would then be related to the environmental conditions of the area (e.g., temperature, salinity).

WALL-E

The organization developed a system of cameras, which they named "Wallie" due to its close resemblance to the robot in Disney Pixar's "Wall-E" movie. The camera system was positioned in front of some large *D. ramea* colonies. For about three months, one camera, equipped with synchronized flash, continuously took a picture every 4.5 m/15 ft; another camera video-recorded one minute every hour. In addition, we deployed environmental sensors to collect temperature and salinity data on the sites.

GUE divers were tasked with correctly positioning the cameras underwater and retrieving them at the end of the scheduled period. Two teams of rebreather and Tech 2 divers completed the camera positioning in June. At the end of October, the cameras were recovered.

TEST RUN

Before the start of the project, it was important to test the different phases of Wallie's placement as well as its functionality at a lower depth. The first important logistical consideration for our test was finding a site where we could position the instrument with consideration to the duration of time the cameras would be there. We wanted a site we knew well, but one that was also rarely visited by other divers and fishermen in order to avoid damage or theft of our camera setup.

This testing phase was important because once we entered the water, we immediately realized the difficulty of transporting Wallie, which was composed of the camera and flash as well as a heavy tripod on which to fix the equipment for stabilization during the shooting phases. Moreover, the fixed length of the tripod's arms proved to be an obstacle for the correct positioning due to the not-always-flat morphology of the sea bottom. Another important aspect of the test run was to verify the range of distance we could place Wallie to ensure proper coverage of the coral colonies.

PHOTO **CLAUDIO PROVENZANI**

Different phases of recording time of the coral Dendrophyllia ramea *using the "Wallie" camera positioned at 78 and 86 m*

All these issues were resolved before the start of the project, which ran between June and October.

The site, well-known by Fabio, the owner of Capo Murro Diving Center, who also provided us with logistical support for the dives, is characterized by a large rocky horst covered by soft sediments; here, we found abundant colonies of this typically infrequent coral. We selected an area between 75 and 85 m/246 and 279 ft deep, where we had observed the largest number of *D. ramea* colonies growing up to 80 cm/31 in. tall. On two dives, two teams of RB80 and Tech 2 divers positioned the two Wallies. On each tripod we added a sensor for temperature and salinity to help us better understand the biological condition of the living colonies.

INNOVATIVE APPROACH

Inclement weather conditions forced us to perform the recovery phase in one dive at the end of October. The two Wallies were removed from their positions and taken to a meeting point fixed near the shallower zone. They were tied together to avoid as much damage as possible, and were sent to the surface by a lift bag, which was also connected to the shot line used for the diver's descent.

Different encrusting organisms, mainly polychaete and molluscs, covered the instrumentation but fortunately did not colonize the photo/video lenses. The internal electronic parts were perfectly preserved despite the time spent in water and the depth at which they were positioned.

This innovative approach has yielded great results and once again demonstrates the importance of well-trained divers as well as continued monitoring at the site, perhaps with a dedicated Project Baseline. The increase in scientific knowledge of *D. ramea* obtained, thanks to the collection of these data, will be an excellent starting point for studies on species of similar conservation interest. In addition to a good opportunity to engage a high number of trained GUE divers in data collection activities, the project presents the possibility of providing an important dataset, otherwise difficult to obtain, to the scientific community.

TEAM

The GUE/BBX team members involved in the various phases of the project included Andrea D'Ambrosi, Claudio Provenzani, Elena Romano, Emiliano Ricci, Fabio Portella, Giuseppe Barbieri, Massimiliano Sabatini, Simone Carletti, and Stefano Gualtieri

Scientific support provided by Eva Salvati, and Simone Canese


EXCEED YOUR
EXPECTATIONS
AND EXPERIENCE
A WORLD LIKE
NO OTHER.
HALCYON
Dive Systems
HALCYON.NET

REEF RESTORATION PROJECT IN PORTOFINO

For the past several years, Bruno Borelli and his GUE team at Portofino Divers have collaborated with Carlo Cerrano, a professor in the Marine Biology Department of the Marche Polytechnic University, on a project intended to establish new methods and protocols for the restoration of specific animals that play key roles in the engineering of reefs and deep water ecosystems.

The project is part of the European project MERCES (Marine Ecosystem Restoration in Changing European Seas).

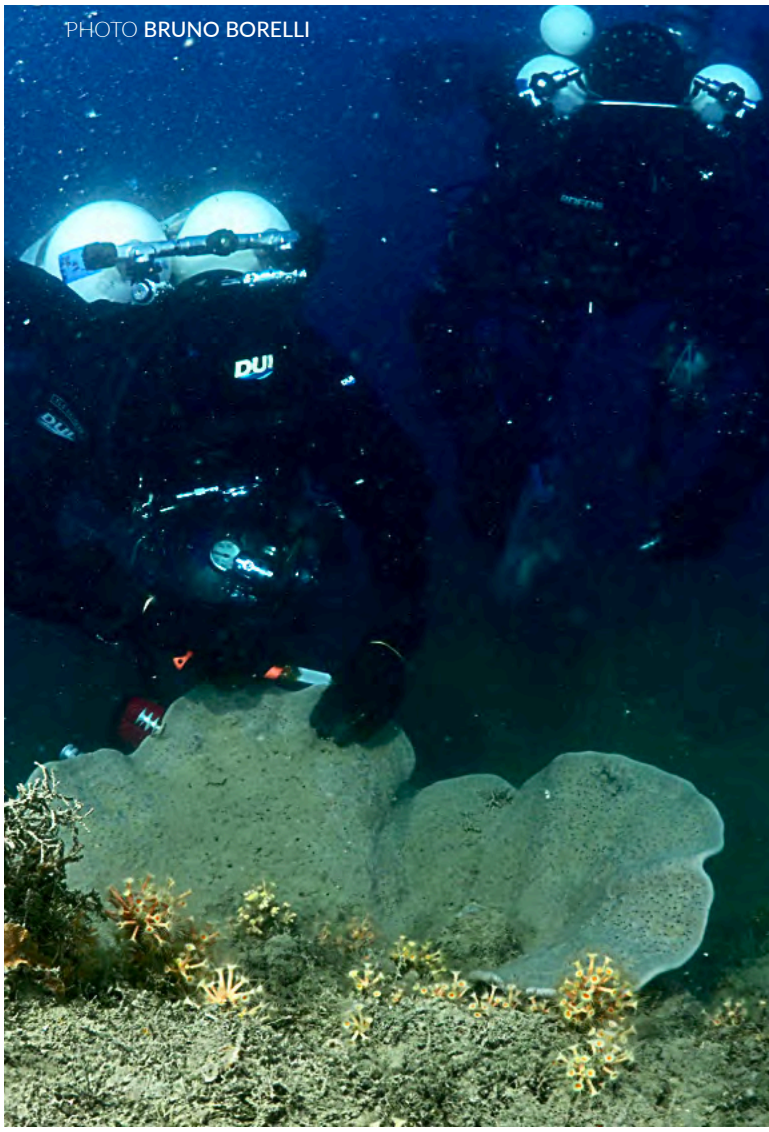
In 2018, efforts focused on two species in particular, the *Corallium rubrum* (the precious red coral) and the *Spongia lamella* (elephant ear sponge).

During several dives, the team experimented with different techniques to implant colonies of corals and individual sponges at depths between 40-70 m/140-230 ft. The results are encouraging, in particular for the sponges, and now the team continues to develop even more efficient methods of implantation. However, more time is needed to assess the efficacy of these techniques with the red corals.

Once protocols are established, additional teams of GUE divers will be needed in order to apply such techniques in selected areas of the Mediterranean Sea.

TEAM

Project director: Professor Carlo Cerrano, Scientific divers: Bruno Borelli, Niccolò Crespi, Andrea Farnesi, Caterina De Seta, and Piero Labò



*Divers took samples from an elephant ear sponge (*Spongia lamella*) that will be re-implanted at a shallower depth.*

PROJECT SEA SHELTERS

On Sunday, October 28, 2018, Project Sea Shelters by Project Baseline Lebanon took its first major step into the Lebanese sea. This initiative, the first of its kind in Lebanon, aims to enrich marine life by providing a shelter that will hopefully attract various fish. Due to overfishing, schools of fish at dive sites are a rare sight, and this project aims to fix this.

An artificial reef was constructed using steel bars, forming a pyramid-like structure weighing slightly over one ton. GUE divers worked together with other dive centers to safely place the reef on a flat, sandy seabed at a depth of 19 m/62 ft. The area is void of any marine life, and the hope is that an artificial reef will attract and shelter numerous fish. Once Phase 1 is considered successful, we will focus on restoring the coral population in the area, and we hope the structure will promote the growth of corals.

In a country lacking government initiative and funding, Project Sea Shelters has had to rely on private funding from its divers. The artificial reef has now been placed, and it is our responsibility to ensure the protection of this reef and the marine life it will hopefully attract. Upon success of this project, it will be presented to the Lebanese Ministry of Environment in order to gain government support to further grow the project across the Lebanese coast.

TEAM

Gerard Ghammachi (Project Manager): GUE Fundamentals instructor, Hala El Khoury (Project Manager): GUE Tech 1 diver, Ziad Bishara: GUE Fundamentals diver and NAUI instructor, Elie Abdel Ahad: GUE Fundamentals diver and TDI Trimix diver, Eli Kmeid: GUE Fundamentals diver and SSI representative, George Assaf: GUE Fundamentals diver and SSI course director, Diane Rouhana: SSI Open Water instructor, and Marwan Haroun: GUE Cave 2 diver

❶ *Project Baseline Lebanon team preparations*

❷ *Transportation of Project Sea Shelters' first artificial reef*

❸ *Resurfacing*

❹ *Team Project Baseline Lebanon*

PHOTOS MARWAN HAROUN

NETHERLANDS

BERGSE DIEPSLUIS

PHOTO **PROJECT BASELINE BERGSE DIEPSLUIS**

Project Baseline is all about regular divers recording observations and collecting data at a specific site to create a baseline understanding of the current state of the environment. While logging our observations at Bergse Diepsluis, we noticed a couple of things.

Reviewing the visibility measurements this year, two things stood out. First, we had the lowest recorded temperatures (-1 degree Celsius) this year, but also the highest measured temperature (25 degrees Celsius) since monitoring began in March 2016. Secondly, the boundary at which vegetation and life underwater starts has become shallower. We also observed a kind of fungus formation on the soil. One of our objectives for 2019 will be to monitor and document these environmental changes to the best of our ability.

Furthermore, we held a cleanup this year, during which we collected the litter both above and below the water line. A new Project Baseline sign was placed at the dyke stairs, and everyone who passes by can quickly learn how to take a visibility measurement and where to submit the data.

Besides the typical measurements collected at other Project Baseline sites, we collaborated with enthusiastic members of the Sepia Project. This project focuses on placing sticks so the sepias, or cuttlefish, are able to deposit their eggs during mating season. Over the years, the number of sepias has decreased, and by providing a location where the animals can lay their eggs, we hope to improve their mating environment.

We look forward to steaming into 2019 with new objectives and a lot of enthusiasm.

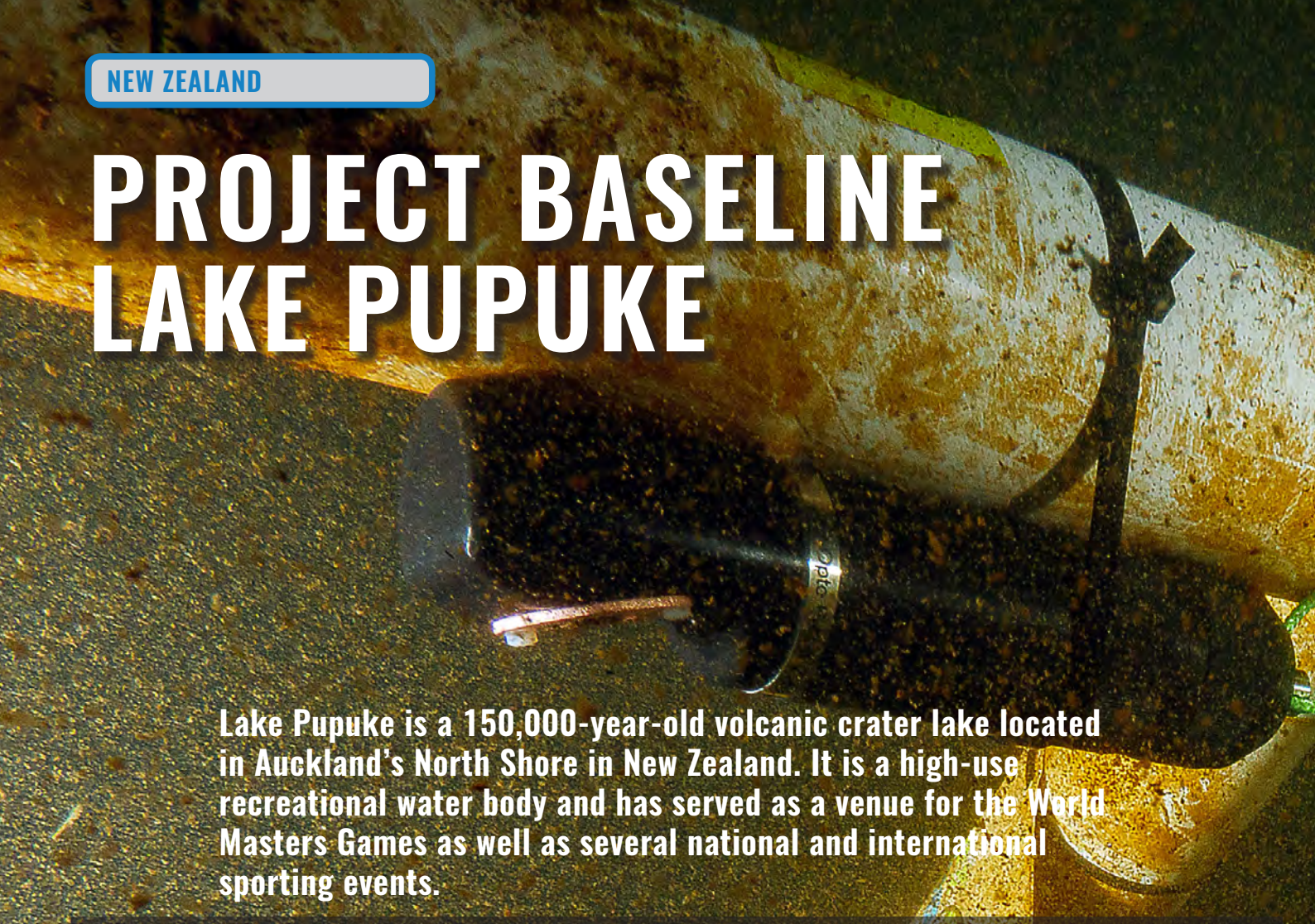
- René van der Laan, Project Manager, Bergse Diepsluis

PHOTOS PROJECT BASELINE BERGSE DIEPSLUIS

The group organized a cleanup in 2018.

NEW ZEALAND

PROJECT BASELINE LAKE PUPUKE



Lake Pupuke is a 150,000-year-old volcanic crater lake located in Auckland's North Shore in New Zealand. It is a high-use recreational water body and has served as a venue for the World Masters Games as well as several national and international sporting events.

The lake has numerous interesting features that make it unique; for example, the large lake drains a fully urban catchment and has no direct in- or outflows. Water enters the lake via a variety of diffuse sources (e.g., runoff, groundwater, and rainfall) and exits through evaporation and intermittent drainage channels leading out to the neighboring beaches. As a result of this relatively stagnant flow regime, Lake Pupuke has a high water-retention time, which means that a parcel of water could take several years to fully cycle through it.

Concerns regarding the deterioration in water quality have been raised by the local community over the past several years, and reduced subsurface water clarity has been noted by dive schools operating in the lake.

ANNIVERSARY

In June 2018, we celebrated the one-year anniversary for Project Baseline Lake Pupuke, and it has been a big year for us.

We had volunteers from various backgrounds, including a few scientific divers from the United States Geological Survey and GUE's Amanda White, who braved the cold, murky water with us.

All the support from these willing volunteers has enabled us to achieve so much this year. Here are the highlights:

We have conducted more than 25 data collection dives this year. On average, we visit the monitoring stations every two weeks, which provides an amazing high-frequency data set that can be used to track algal bloom development as well as subtle seasonal changes.

We have collected some amazing footage with the help of Boxfish Research 360° cameras. These photos have been great for public outreach, as they are more interactive than standard photos and video.

We hosted a Project Baseline event with presentations from local GUE members, and we featured Amanda White as a guest speaker from Project Baseline HQ. This event raised the profile of both GUE and Project Baseline, and we had a lot of interest regarding both organizations. It was a great platform to introduce people to the initiative and show them how they could contribute and get involved.

We presented at various forums, which allowed us to showcase the work being done and use the project as a case study for effective, collaborative citizen science. These forums also provided a great opportunity

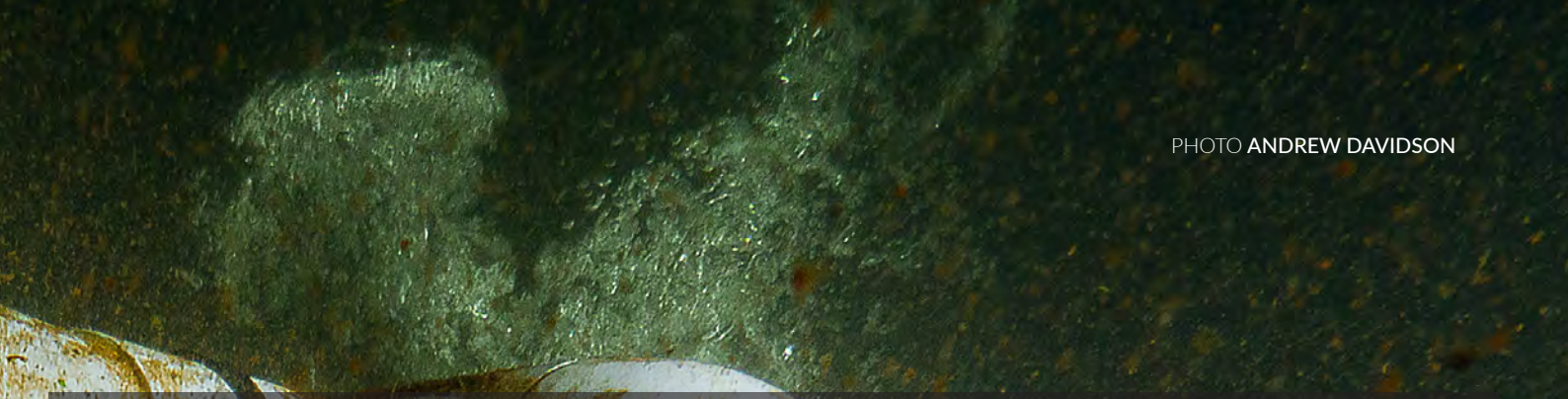


PHOTO ANDREW DAVIDSON

to raise awareness for both GUE and Project Baseline.

We presented to a variety of audiences, including: The 50th Annual New Zealand Freshwater Sciences Conference, National Lakes Focus Group University dive clubs, and several dive shop events and presentation sessions.

We actively participated in the National Working Group for Citizen Science with the Ministry of the Environment. We have included aspects of this project into a proposed national framework for citizen science-based environmental monitoring.

MEDIA INTEREST

Several media platforms have featured our efforts, which has allowed us to reach a wider audience and promote the work done by us and the wider organization. Media platforms that have featured us include: *Quest Magazine, Knowledge Auckland,* and *Monitoring & Research Quarterly.*

We have completed several continuous water quality profiles to identify key issues and areas of interest. We have identified areas of anoxia within the macrophyte beds, which cover a larger surface area than the deeper hypolimnion. This is important because anoxic conditions drive nutrient remobilization from sediments, which in turn causes eutrophication. If we intend to manage anoxia in the lake as a means of limiting further eutrophication, we should focus on the largest contributing area of anoxia.

DATA COLLECTION

We have installed several continuous dissolved oxygen and temperature sensors at key sites and study areas. These sensors record data every 15 minutes and allow us to track diurnal variation. We use this data to assess how frequently these areas experience reduced oxygen concentration and elevated temperatures.

We have identified and informed targeted studies on macrophyte dead zones, anoxia, and nutrient mobilization, and have collaborated with the Auckland Council, Cawthron Institute, and the National Institute of Water and Atmospheric Research (NIWA) on further investigating the key drivers of lake health decline that we identified. This project involves using the data from the continuous sensors we installed along with the nutrient and particle size distribution analyses of the sediment cores we collected from various sites to estimate the potential internal nutrient loading occurring in various parts of the lake.

This will inform mitigation measures and guide the targeted management strategies conducted by the Auckland Council.

COLLABORATIONS

We have set up a year-long collaborative project with the Auckland Council aimed at using photosynthetically active radiation sensors and dissolved oxygen loggers to monitor littoral zone extent and environmental respiration. This will provide an overall indication of lake health, as we have found this zone to be the dominant nutrient assimilation area in the lake. This information will feed into the wider management strategy conducted by the Auckland Council.

We have set up and been approved for a project to monitor macrophyte recovery rates that will begin in 2019. This involves removing macrophytes from a test site and documenting the recovery rate over time. We will also have a station to monitor the rate of macrophyte extent reduction. We will use the data from these surveys along with the continuous water quality data to relate a reduction in photic zone depth to a reduction in macrophyte extent. This can then be correlated to a reduction in nutrient assimilation and an increase in eutrophication, which is indicative of a shift toward an algal-dominant system.

We have sampled the lake for microplastics and have removed a lot of stray fishing line and rubbish from the lake.

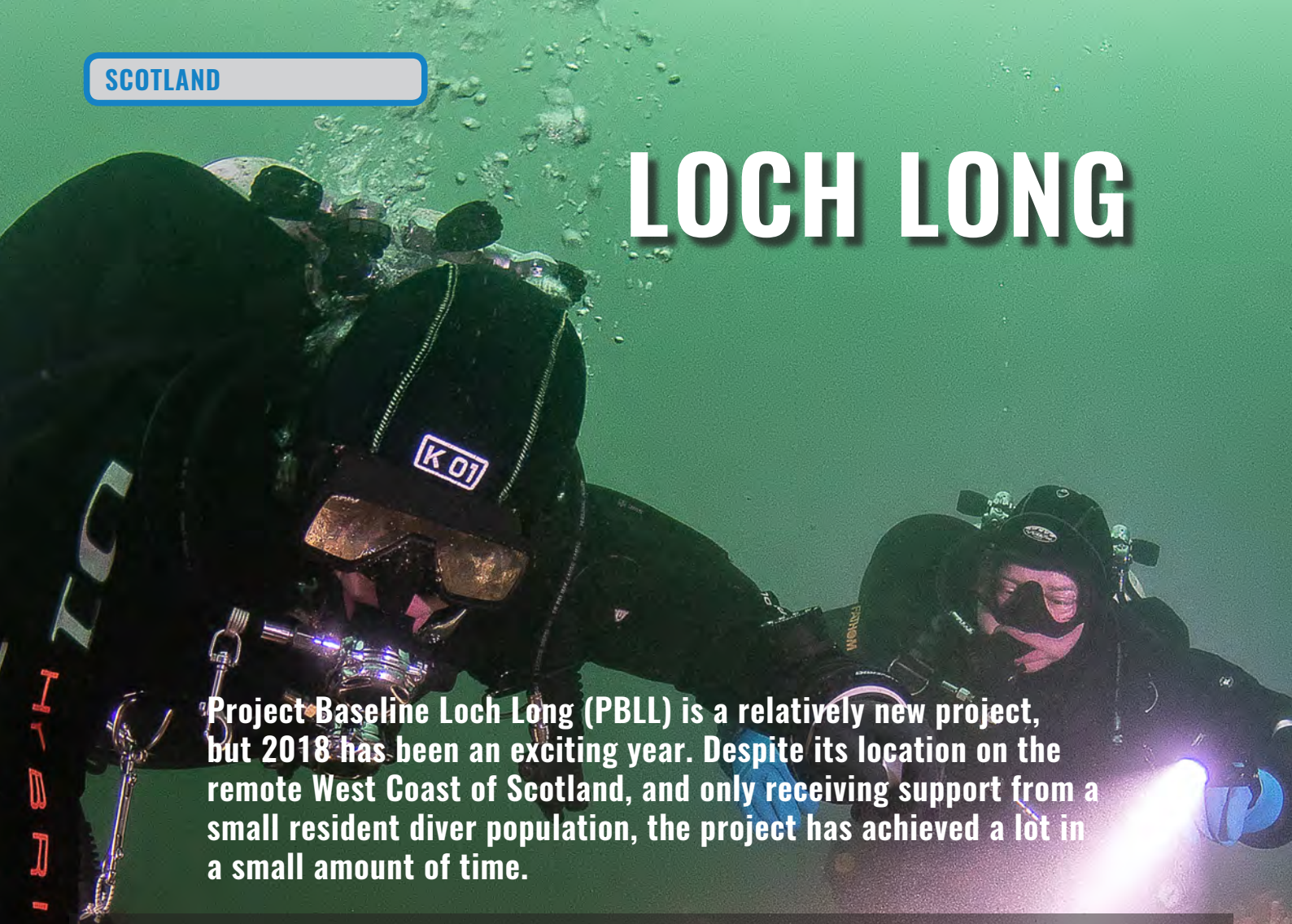
We have received several awards for our efforts, including: feature project for Auckland Conservation Week, finalist in the Mayoral Conservation Award, and the Project Baseline Scholarship Award.

TEAM

Ebrahim Hussain, Mark Long, Mike McMurtry, Philippe Guerra, Tyler Ungureanu, Russell Hughes, Louise Greenshields, and Mike Batey

A huge thank you is deserved by everyone who has volunteered and assisted on the project.

LOCH LONG



Project Baseline Loch Long (PBLL) is a relatively new project, but 2018 has been an exciting year. Despite its location on the remote West Coast of Scotland, and only receiving support from a small resident diver population, the project has achieved a lot in a small amount of time.

Loch Long is situated in the Trossachs National Park, about an hour north of Glasgow. One of the attractions of the project location is its outstanding natural beauty, making it a popular location for many outdoor pursuits. The area is dominated by an intricate network of sea lochs, creating hundreds of miles of jagged coastline. Due to the remote location and challenging logistics to access the area, much of the West Coast of Scotland is rarely visited by divers. However, this is not the case for Loch Long. The site chosen for PBLL's first station is frequented by recreational divers and dive schools, making it easy for divers to get involved in the project, one of the reasons for choosing the spot. The site is also located less than 100 m/328 ft from a commercial fueling jetty, another reason for wanting to monitor the underwater conditions in the area.

INTERESTING DISTRACTION

Loch Long has an interesting history. Between 1912 and 1986, the British military used the loch as a torpedo testing site; records show that in 1944, as many as 12,000 torpedoes were fired. As torpedo technology advanced and moved away from straight-running weapons, the loch became less suitable for testing, so the military started using alternative sites for firings. While the buildings associated with the range were severely damaged by fire in 2007, the remains of the supporting infrastructure can still be seen. With a large naval base nearby, the loch and surrounding area is still used extensively by the Royal Navy, and the occasional glimpse of a warship or submarine makes for an interesting distraction during those chilly surface intervals.

USEFUL COLLABORATION

As well as setting up the monitoring station in the loch, project members have started documenting the various flora and fauna found in the area. To do this accurately, the team has formed an extremely useful collaboration with Seasearch Scotland. This organization trains recreational divers in underwater species identification and survey techniques, an ideal tool for project members. The two-day Seasearch course runs divers through the process of completing survey forms and provides the tools required for accurate species identification.

Surveys can be completed anywhere in the UK, making the training ideal for divers wanting to contribute to the scientific community.

PHOTO **MARCUS ROSE**

Visibility station in Loch Long

PHOTO GARETH LOCK

GLOBAL PROBLEM

One member of the project team is a postgraduate student at Glasgow University and has helped form a PBLL collaboration with a research student who is investigating the presence of bacteria in marine sediment. The work aims to identify Actinobacteria, which produce 80% of the world's antibiotics. Antimicrobial resistance is a global problem that is predicted to result in approximately 10 million deaths annually by 2050, a sobering statistic. The discovery of new antibiotics is rare as terrestrial strains of Actinobacteria have been extensively explored and exploited. The search has now moved to marine sediments. With 70% of the earth's surface covered by water, and limited sampling from marine environments to date, it is hoped that this research will see success. PBLL team members have collected a number of samples for study, including sites within Loch Long, and are looking forward to hearing the results.

FANTASTIC SUPPORT

To help accelerate the completion of project goals, PBLL held the first "Project Weekend" this year, which is set to become an annual event. The weekend saw 20 divers from across the UK and Europe come together to help continue the documentation efforts. Over the two days, divers continued with survey efforts, submitted station data, and progressed with their species identification skills. The weekend was well supported, with a number of GUE instructors attending to run skills workshops. The opportunity for a social could not be missed, so the weekend included a presentation evening as well. Talks featured human factors in diving from Gareth Lock, flora and fauna of Scotland from Owen Paisley of Seasearch, and Project Baseline Sardinia from Andrea Marassich. Without the fantastic support of the divers that attended, the project would not have achieved what it has this year.

SCHOLARSHIP FUNDING

To top off a great year of project diving, PBLL was selected as one of three projects to be awarded scholarship funding to help progress the project over the next 12 months. Members are carefully considering how best to use the funds to ensure they are used to collection of valuable and relevant data.

Project members are looking forward to the next 12 months, most notably, making good use of the scholarship funding and bringing the full team together for a second project weekend. There are plans to visit some of the less accessible areas of the loch too, such as the western side that requires DPVs to gain access, to conduct further species identification and sediment sampling. The team is also looking forward to providing a further update in next year's annual report.

TEAM

Marcus Rose, Ryan McShane, Andy Pilley, Owen Flowers, Pete Ellwood, Scott Pendry, Gareth Lock, Andrea Marassich, James Sanderson, Sergej Maciuk, Andy Rath, Kerry Place, Dan Knott, Owen Paisley, MG Pi, Alana Dempsey, and Richard Harpin

THE DIFFERENCE IS IN THE DETAILS.

WWW.HALCYON.NET