BENTHIC HABITAT MAPPING OF TUNG PING CHAU MARINE PARK

A journey to discover the ecological important habitats in one of the marine parks in Hong Kong

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In 2019, the Agriculture, Fisheries and Conservation Department (AFCD) commissioned a team of specialists led by the State Key Laboratory of Marine Pollution from the City University of Hong Kong and supported by Chinese University of Hong Kong and the Education University of Hong Kong to carry out a benthic habitat mapping study for Tung Ping Chau Marine Park (TPCMP).

Accurate and extensive marine habitat maps are essential for planning and making informed decision for habitat management. This featured story aims to introduce the habitat mapping technique and share some of the interesting study findings with the general public. Through reading, we hope to enhance public understanding of marine biodiversity of the marine park and seek their support in protecting the marine environment.

OBJECTIVES OF BENTHIC HABITAT MAPPING

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TPCMP was designated as marine park in 2001 under the Marine Parks Ordinance, protecting a total of 270 hectares of sea area. It was the fourth marine park in Hong Kong. This marine park supports rich and diverse marine habitats and species including 65 species of hard corals, 41 species of octocorals, 6 species of black corals and more than 65 species of macroalgae. It is also home to some rare octocoral species, *Sansibia* sp. and *Elbeenus* sp. The presence of such a diverse and essential seafloor habitat is home for different fish, invertebrates and is important to living marine resources and ecosystem services.

Despite a wealth of information are available on the key benthic habitats of the TPCMP, the data collected are of limited coverage in terms of the location and the extent/ coverage of those benthic habitats. With the recent advancement of the seabed mapping technology, it is considered timely to conduct a habitat mapping study to identify the extent, types and coverage of substrates and key benthic habitats within TPCMP by innovative methods, with a view to providing more comprehensive ecological information for enhancing long term monitoring and prioritizing conservation effort in the marine park.

HABITATS TO BE MAPPED: HARD CORALS

Coral reef is one of the most complex and productive marine ecosystems in the world which supports a high diversity of marine organisms. They are often described as the Tropical Rainforest of the Sea. Since Hong Kong is located in the subtropical region, corals here do not form reefs, yet they form communities in shallow coastal waters.

TPCMP is one of the best coral-growing sites in Hong Kong. Detailed mapping on the spatial distribution, complexity, type, percentage cover of the coral communities can help in devising management strategy to better protect the coral communities in the marine park.
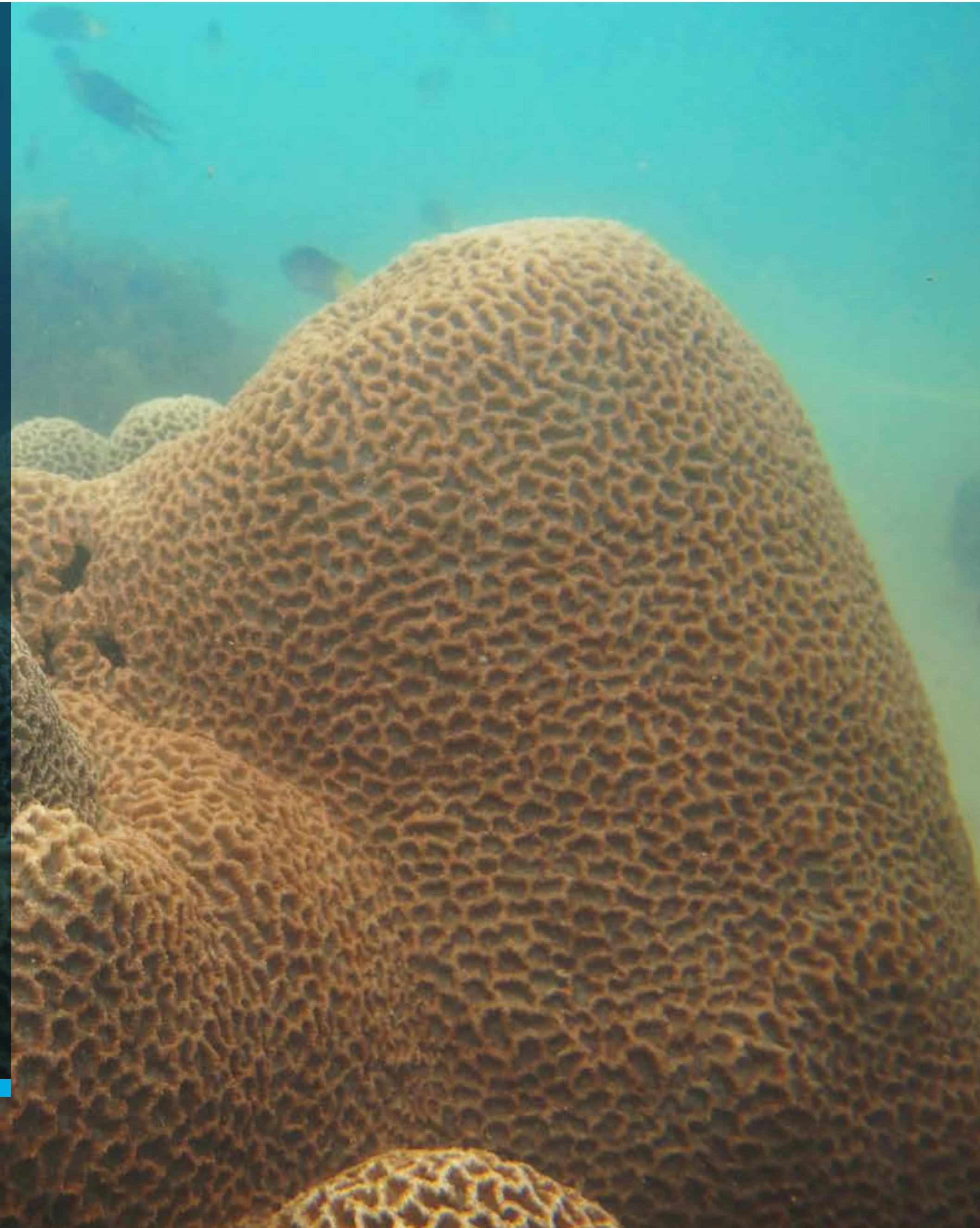
HABITATS TO BE MAPPED: OCTOCORAL & BLACK CORAL

Octocorals and black corals are often found in greater depth since they do not rely on zooxanthellae for photosynthesis, unlike hard corals.

Nonetheless, they are important members of the benthic community. With their growth form, they provide structural complexity to the ecosystem and forming a habitat and refuge for a variety of fauna.

HABITATS TO BE MAPPED: SARGASSUM

Sargassum, one of the signature macroalgae, showing a strong seasonality thriving from October to around May in Hong Kong waters.

Beds of *Sargassum* which can grow up to 2-3m in length are often found to be important nursery habitats for various juvenile fish and invertebrates e.g. molluscs and echinoderms, which provides shelter and protection to juveniles that are vulnerable and susceptible to predators.

SURVEY METHODOLOGY
TIER 1 SURVEY - IDENTIFYING HARD BOTTOM HABITAT

To effectively manage and protect these diverse benthic communities, benthic habitat mapping is commenced to accurately measure the spatial distribution and extent of the key habitats within the whole TPCMP.

The project team collected data using rapid and non-invasive multiple acoustic imaging techniques and Unmanned Aerial Vehicle (UAV) to visualize an extensive area of seafloor to identify areas of hard bottom substratum. Hard bottom substratum provides the foundation where macroalgae, octocoral and black coral species can possibly grow on, while it can also mean an extensive formation of hard coral habitat on seafloor.

SURVEY METHODOLOGY

TIER 1 SURVEY – IDENTIFYING HARD BOTTOM HABITAT

(A) ACOUSTIC SURVEYS
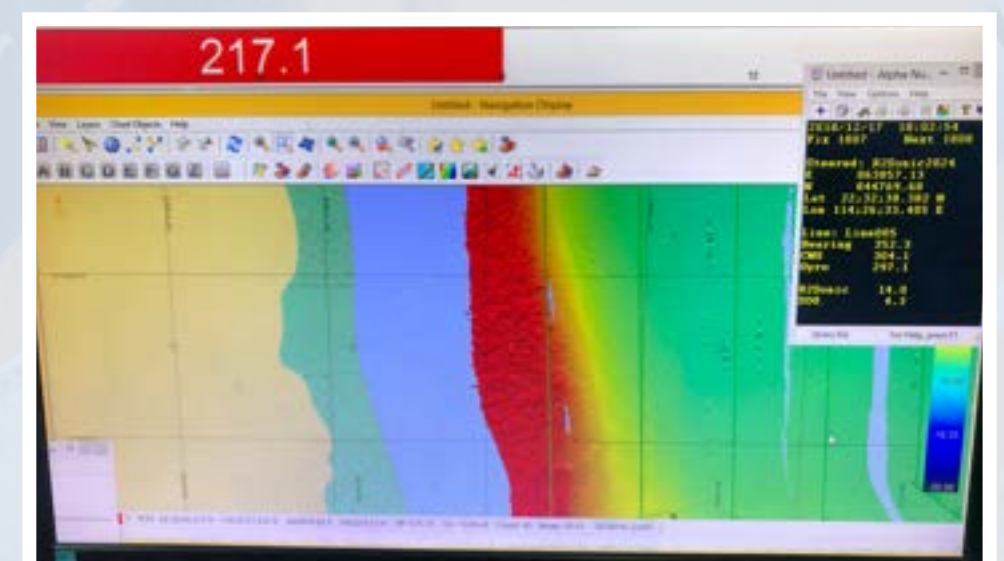
① Multibeam echosounders (MBES)

It is a type of sonar technology from which shaded-relief topographic maps, bathymetric maps and backscattering maps can be generated which is vital for the planning of the proceeding sampling surveys for acquiring biological information in the same area. It gives information on depth (bathymetry) and texture (backscatter) of the seafloor.
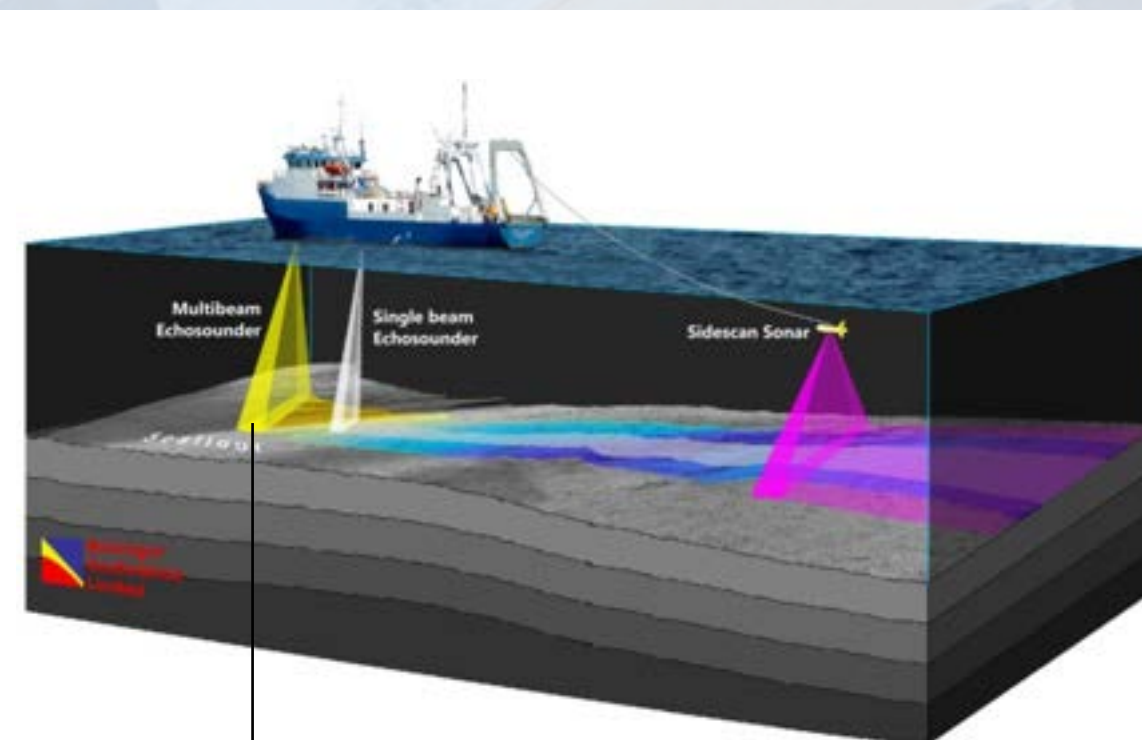
① Multi-beam echo sounder (MBES) has a wider swath (yellow)

▲ Vessel is following the planned survey route for MBES scanning

▲ In the process of MBES scanning on seafloor in Tung Ping Chau Marine Park

(A) ACOUSTIC SURVEYS

② **Single-beam echosounders (SBES)**

SBES has relatively narrow beam width as compared with MBES, thus making it impracticable to do a full area search in deeper water. However, since SBES can be run on smaller vessels which have shallower draught, it can be used to acquire bathymetric data in very shallow water. It is an independent system to the MBES, and therefore by comparing results from both systems, SBES can be an excellent quality control tool.

② Single-beam Echo Sounder (SBES) has a narrower swath (white)
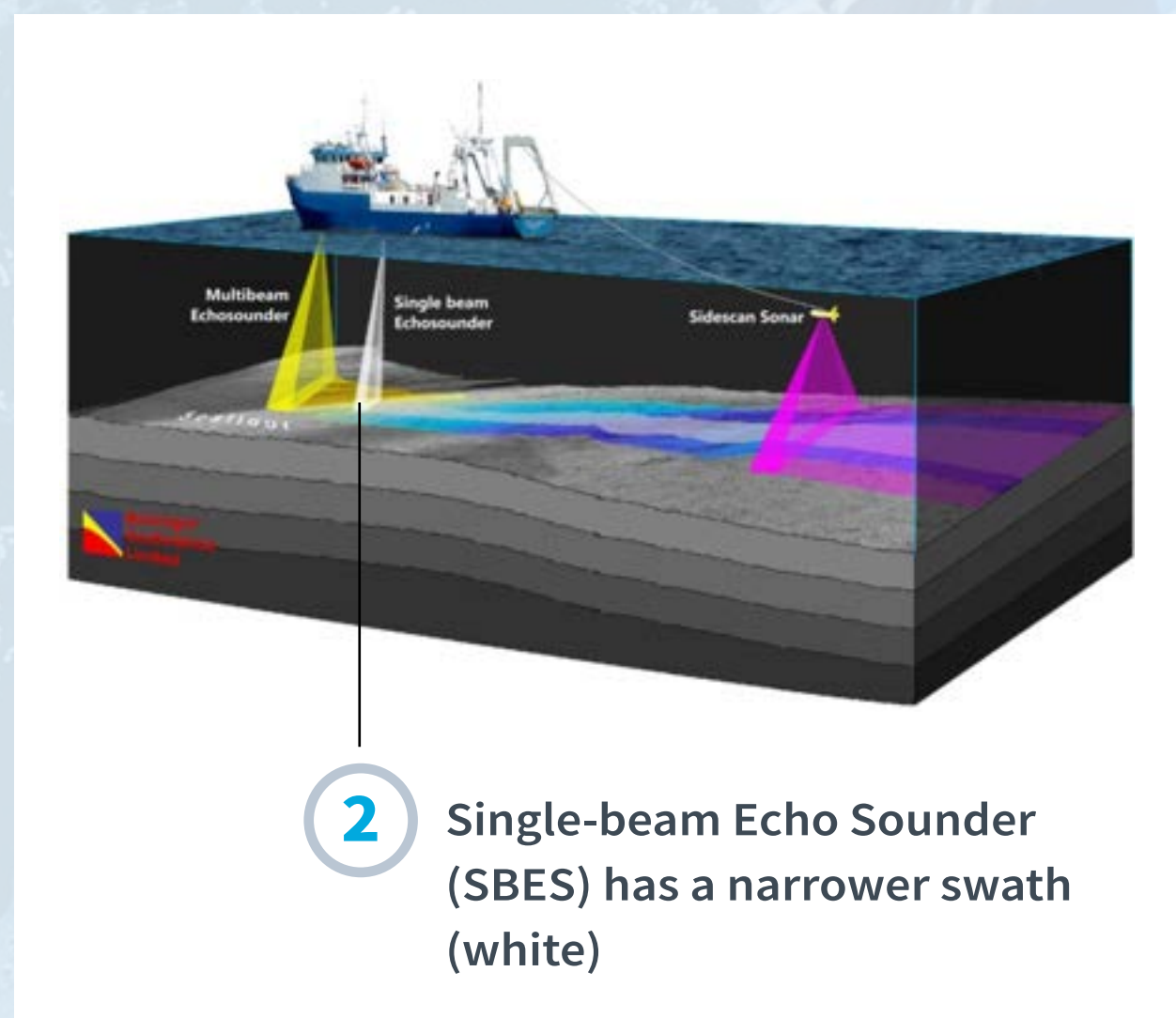
▲ In the process of Single-beam Echo Sounder (SBES) scanning

▲ Conducting Single-beam Echo Sounder (SBES) in shallow water

SURVEY METHODOLOGY

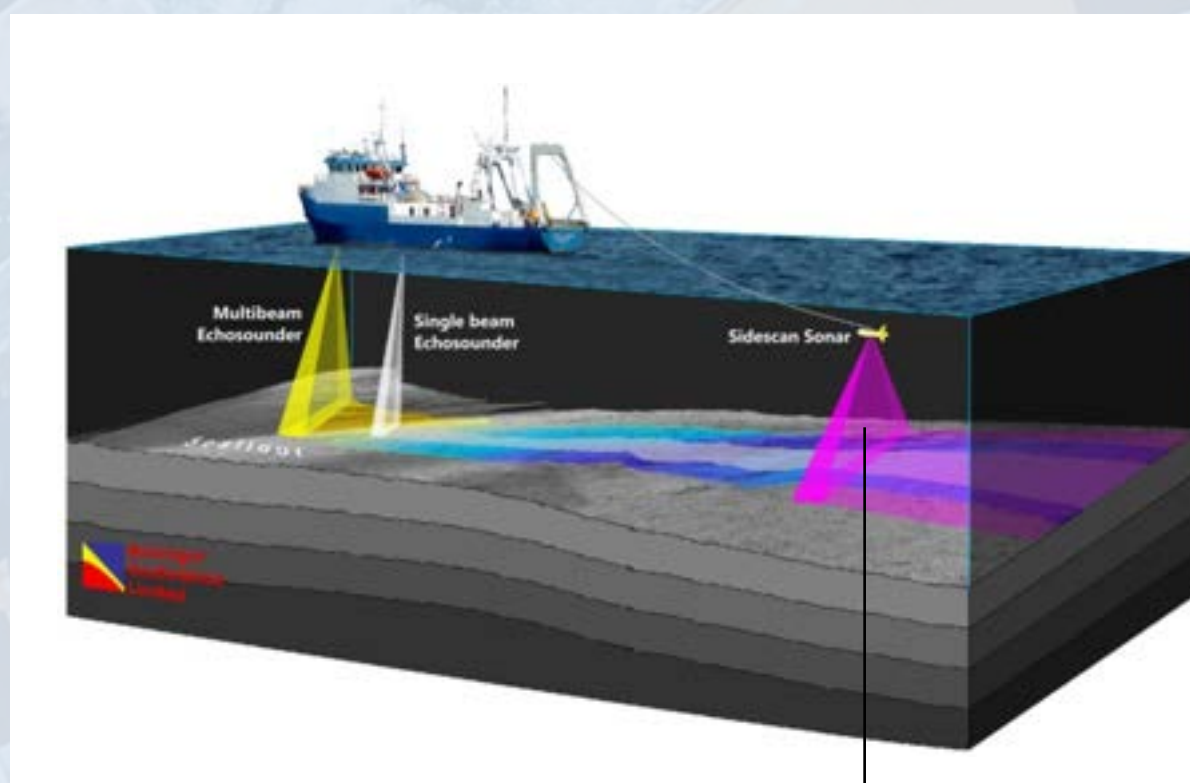## TIER 1 SURVEY – IDENTIFYING HARD BOTTOM HABITAT

SURVEY METHODOLOGY

TIER 1 SURVEY – IDENTIFYING HARD BOTTOM HABITAT

(A) ACOUSTIC SURVEYS

③ Side scan sonars (SSS)

SSS is commonly used to detect specific targets on the seafloor such as pipelines, wrecks, sunken objects or to investigate seafloor morphology and sediment characteristics.

③ Side Scan Sonar (SSS) (pink)


▲ Side Scan Sonar image showing sand riffles on seabed

Bird eye view from air drone survey

(B) UNMANNED AERIAL VEHICLE (UAV) SURVEY

Unmanned Aerial Vehicle (UAV) Survey - UAV (aka air drone) survey is used to cover the shallow coastal areas which cannot be covered by any acoustic survey. Its aim is to look for suspected hard bottom substrate or any seabed features in shallow water through aerial imagery.
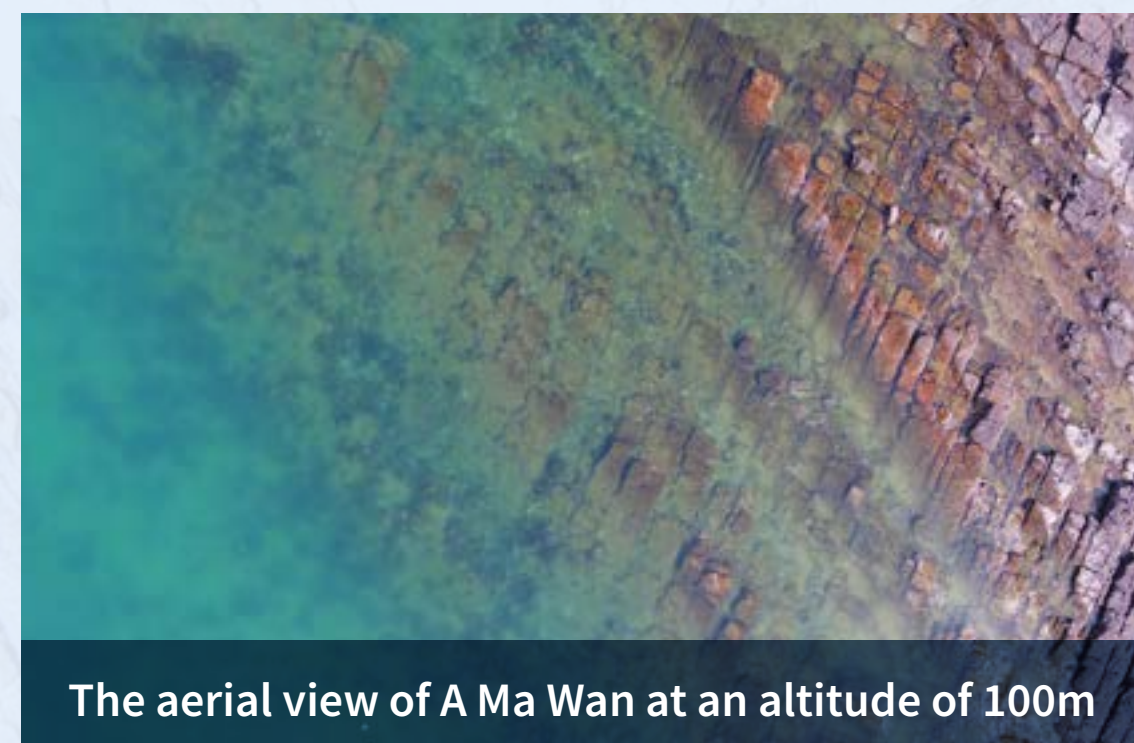
The aerial view of A Ma Wan at an altitude of 100m

Aerial view of *Sargassum* patch on water surface

The aerial view of Cheung Sha Wan at an altitude of 60m

The aerial view of Lung Lok Shui at an altitude of 100m

SURVEY METHODOLOGY

TIER 1 SURVEY – IDENTIFYING HARD BOTTOM HABITAT

SURVEY METHODOLOGY

TIER 2 SURVEY – OPTICAL SURVEYS OF HARD BOTTOM FOR VERIFICATION

Hard bottom substratum identified from the acoustic and UAV imagery surveys would be further surveyed by various methods, including UAV, water drone and drop camera to verify the presence or absence of any ecologically important habitats, i.e. corals and macroalgae and to quantify their coverage, if any.
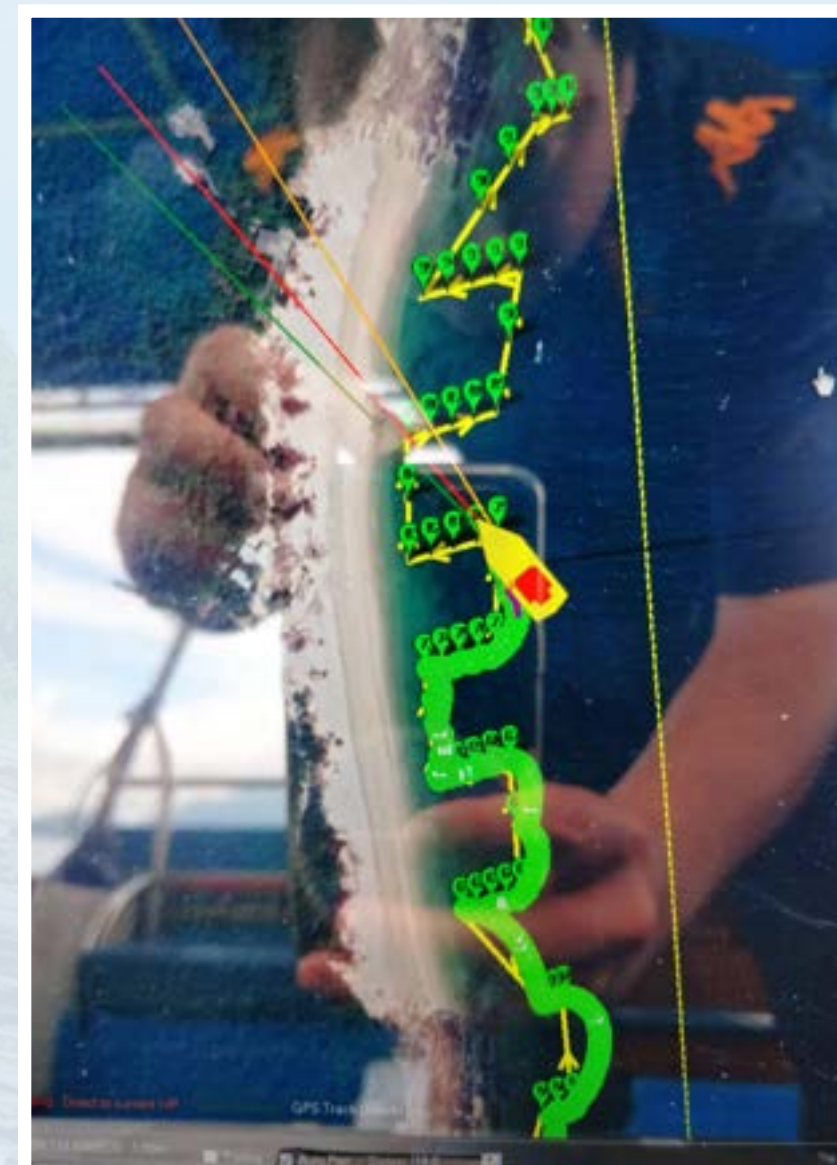
SURVEY METHODOLOGY

TIER 2 SURVEY – OPTICAL SURVEYS OF HARD BOTTOM FOR VERIFICATION

(A) WATER DRONE SURVEY

▲ The DIY water drone equipped with a camera at the bottom for taking photos at regular interval

▲ Water drone is following the planned path during the survey

Operating the water drone for the water drone survey

(B) DROP CAMERA SURVEY

SURVEY METHODOLOGY

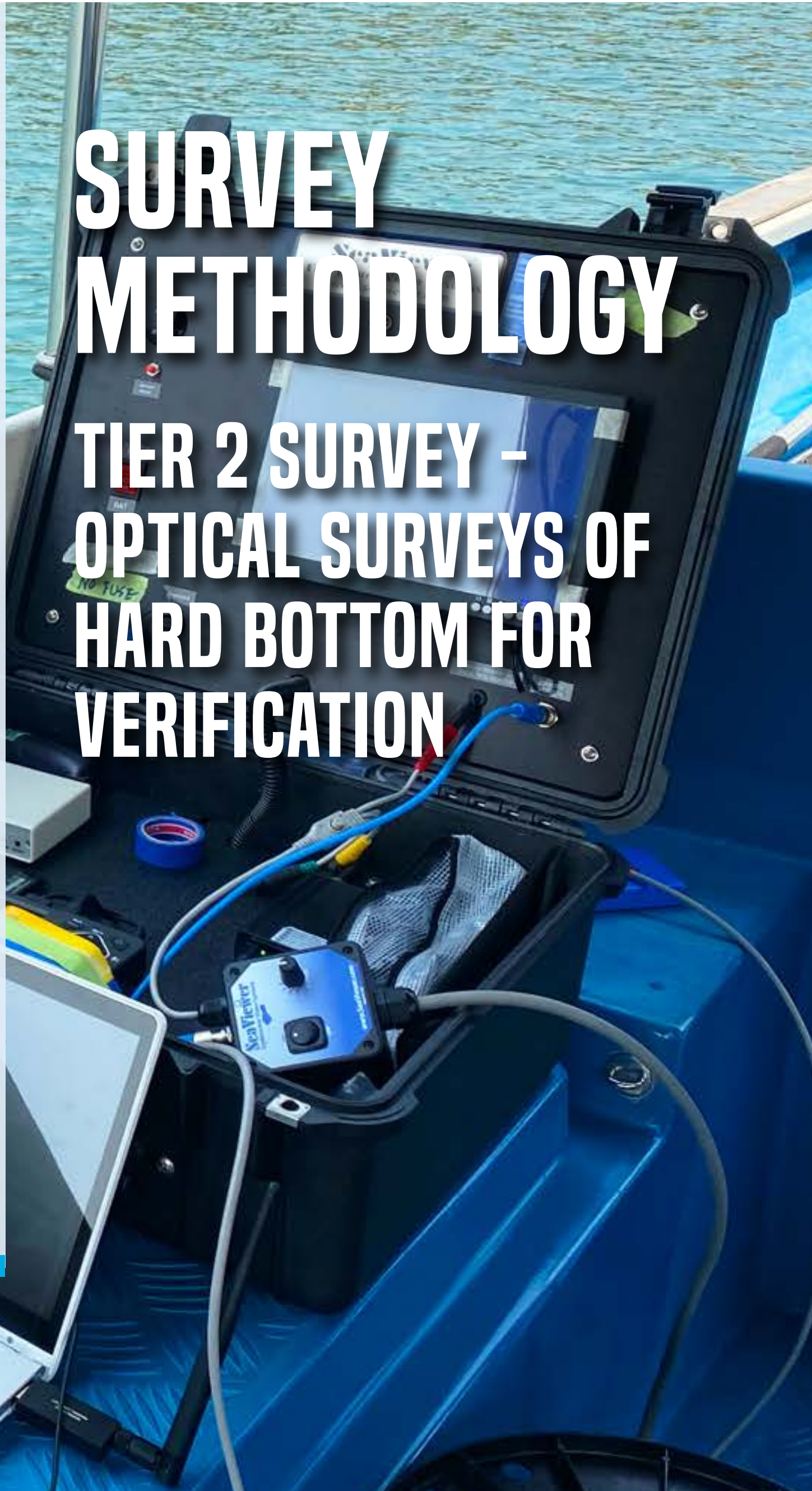## TIER 2 SURVEY – OPTICAL SURVEYS OF HARD BOTTOM FOR VERIFICATION

▲ The drop camera is customized to have 3 laser pointers that are calibrated to allow distance measurement

▲ Footage of octocoral is captured by drop camera during the drop camera survey

MAP OF SUBSTRATE COMPOSITE & BIOTIC COVERAGE

This map shows the substrate types and biotic coverage in TPCMP mapped under this Study.

Legend

Buoy

Core Areas & Mooring Sites
- Core Area– A Ma Wan
- Core Area – Tai Tong Wan
- Mooring Site (Zone A)
- Mooring Site (Zone B)

Wreck

Macroalgae
- Sargassum
- Crustose Coralline Algae (CCA)

Coral
- Black Coral
- Hard Coral
- Octocoral

Geomorphological Structure Type
- Hard coral communities: development of coral communities with coverage more than 10%
- Rock
- Rubble
- Sand
- Artificial Reef
- Tung Ping Chau Marine Park (TPCMP) Boundary
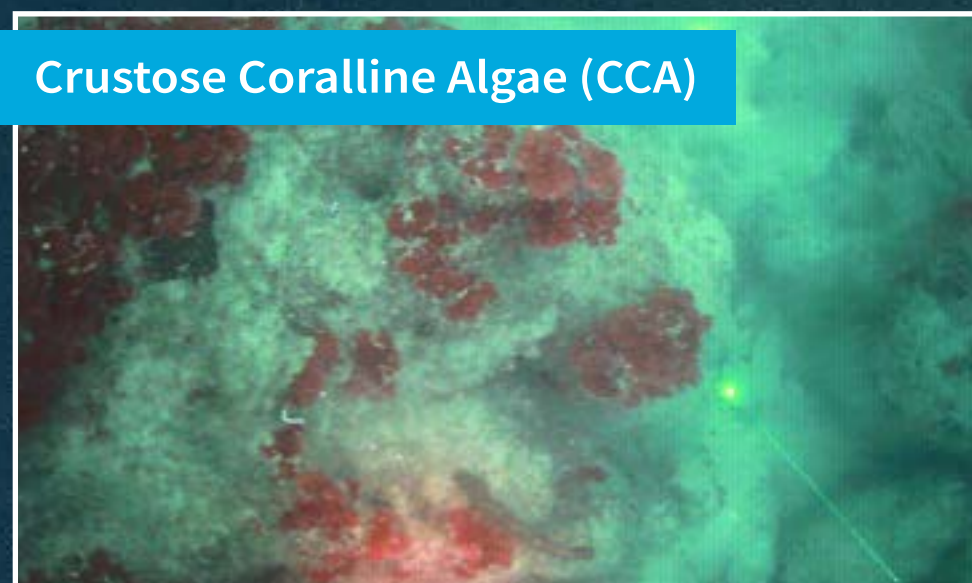- Survey Boundary
- Sandy Beach

Meters

0   250   500

Chau Mei Kok
Ngai Kok
Cham Keng Chau
A Ye Wan
TUNG PING CHAU
A Ma Tsui
Kang Lau Shek
Lung Lok Shui
Chau Pui
Lan Kwo Shui

INTERESTING FINDINGS

Octocoral Community

An octocoral bed was discovered in deeper waters off south-eastern shore of Tung Ping Chau during Tier 2 survey.

Crustose Coralline Algae (CCA)

CCA grows together with octocoral in deeper waters and creates a relatively complex topography on the hard bottom in deep water.

Hard Coral Community

Several large hard coral communities are located in the shallow waters along the northeastern side of Tung Ping Chau.

Sargassum

The highly seasonal *Sargassum* form an extensive habitat along the western shoreline in TPCMP and became sparse in the south. Some large patches of *Sargassum* have also been recorded near A Ye Wan and the pier. It provides important nursery grounds for juveniles of various marine life.
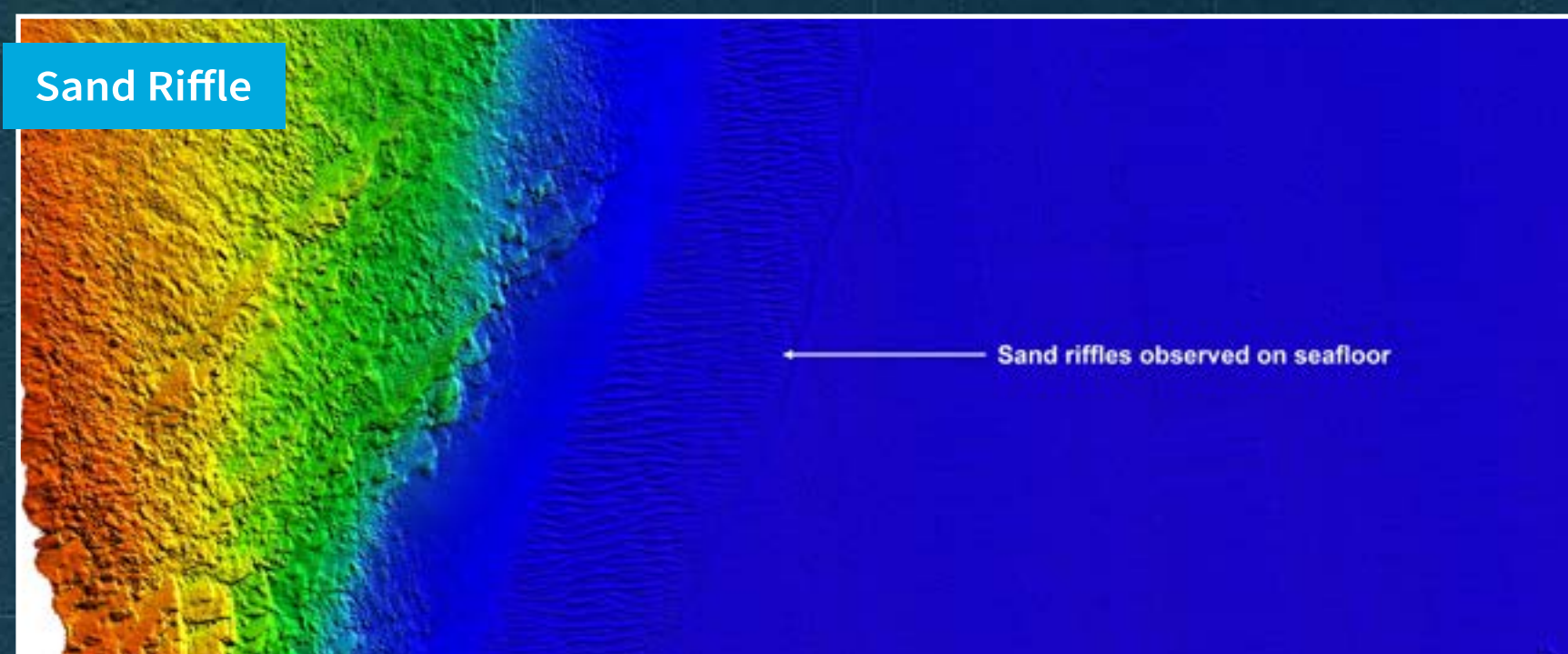
INTERESTING FINDINGS

Wreck

A wreck was found during MBES scanning where some black corals were found on this wreck during optical survey.

Sand Riffle

A belt of sand riffle on the east of Tung Ping Chau was observed on seafloor during acoustic survey.

INTERESTING FINDINGS

1

▲ A wreck is found during Multi-beam Echo Sounders (MBES) scanning, some black corals are found on this wreck.

2

▲ Hard Corals at Cheung Sha Wan

3

▲ Hard Coral at A Ye Wan

4

▲ Hard Coral at Wong Ye Kok

5

▲ Hard Coral at Wong Ye Kok

6

▲ A sea turtle is found during UAV survey

INTERESTING FINDINGS

▲ Hard Coral at A Ma Wan

▲ Hard Coral at A Ma Wan

▲ A belt of sand riffle on the east of Tung Ping Chau was observed on seafloor during acoustic survey

INTERESTING FINDINGS

🔺 Octocoral

🔺 Crustose Coralline Algae (CCA)
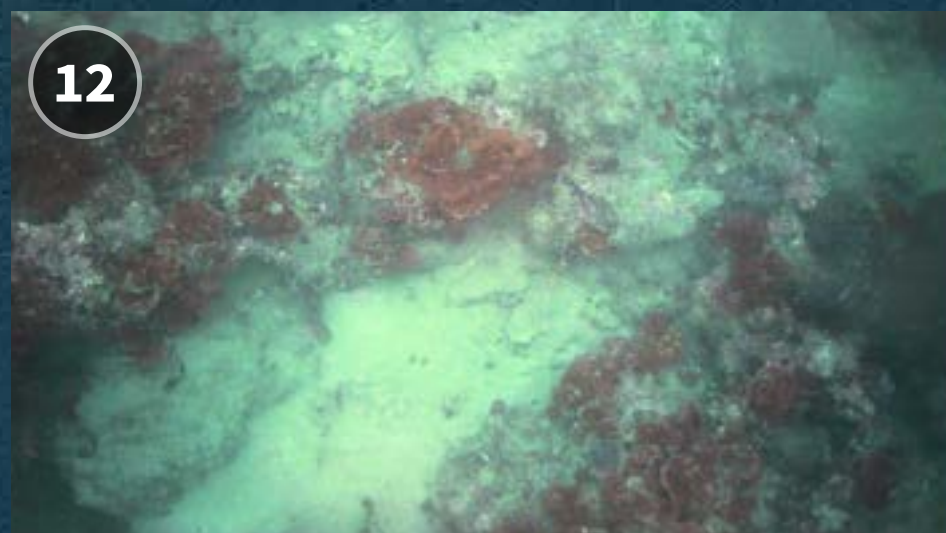
🔺 Crustose Coralline Algae (CCA)

🔺 An octocoral bed is found during tier 2 survey

🔺 Octocoral

SURVEY IMAGES OF HARD CORAL

This section showcases some representative hard coral images taken by different methods during the survey.

HARD CORAL IMAGES TAKEN BY WATER DRONE
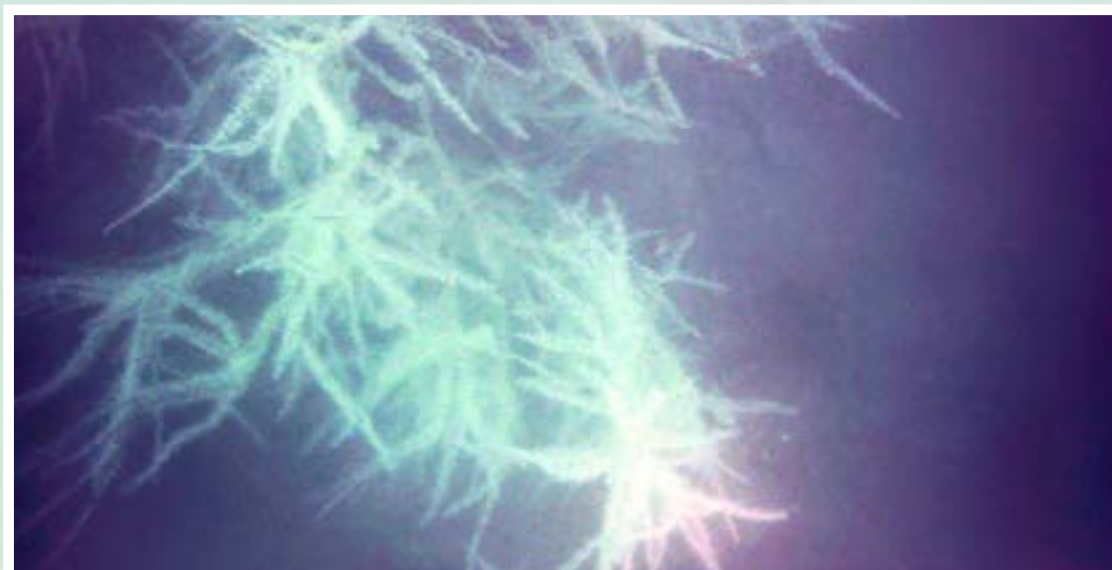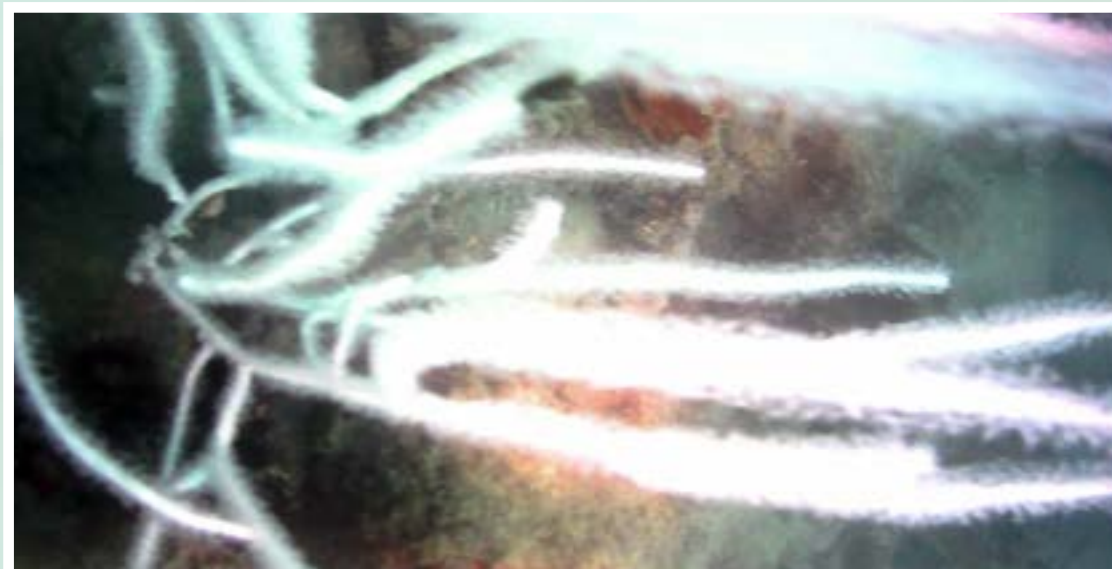
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HARD CORAL IMAGES TAKEN BY DROP CAMERA
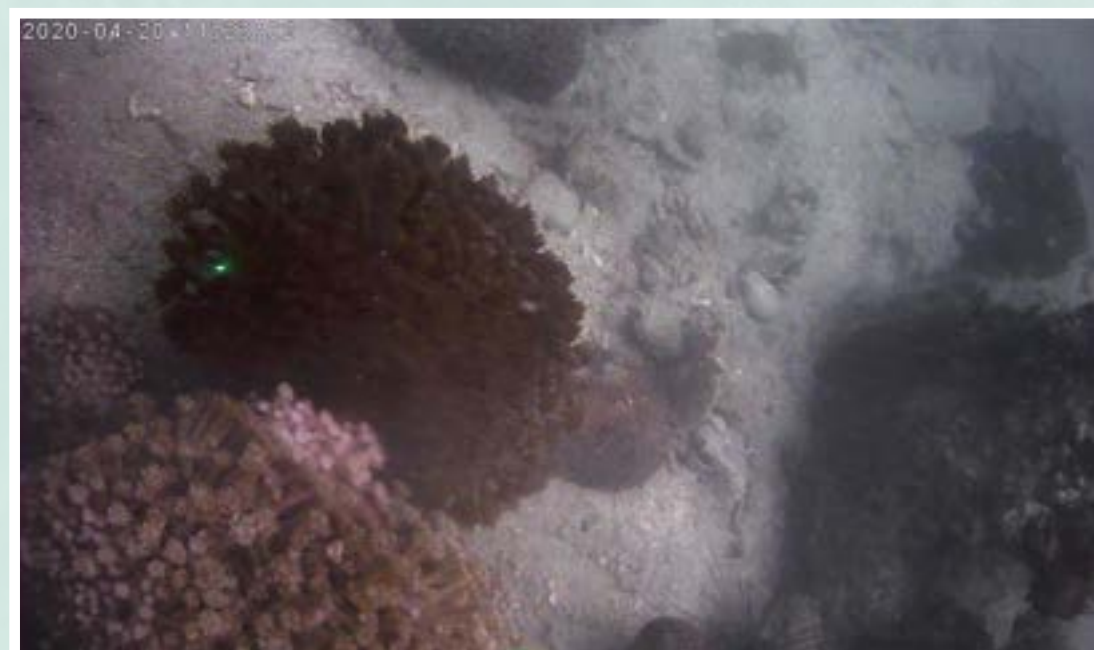
OCTOCORAL / BLACK CORAL IMAGES TAKEN BY DROP CAMERA

SURVEY IMAGES OF OCTOCORALS AND BLACK CORALS

This section showcases some representative images of octocoral and black coral taken by drop camera during the survey.

SURVEY IMAGES OF *SARGASSUM*

This section showcases the *Sargassum* images taken by UAV during the survey.

SARGASSUM IMAGES TAKEN BY UAV

PHOTO MOSAIC

This photo mosaic is formed by a large set of images which are taken by water drone at shallow water in A Ma Wan.

It gives a wider aerial view of the coral distribution at a particular area.
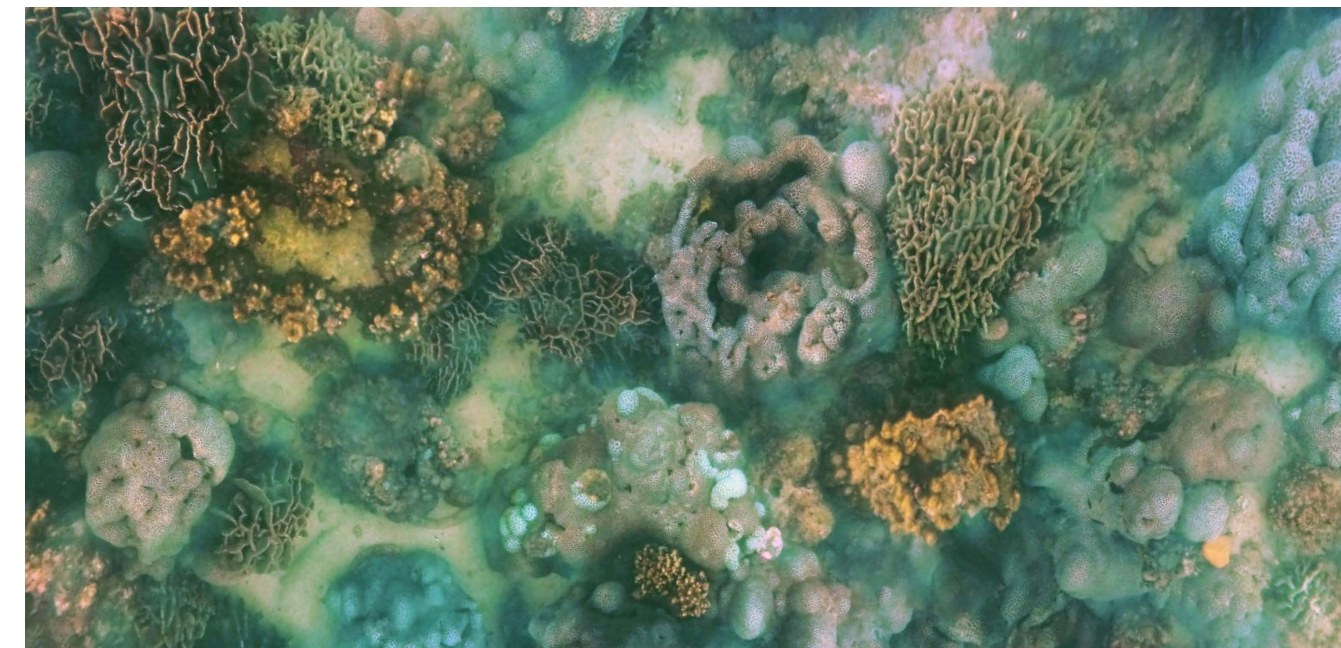
MOSAIC BY WATER DRONE IMAGES

PHOTO MOSAIC

Under this study, the team conducted a trial using photo-mosaicking technique to cover an area of approximately 5m x 5m. By repeated observation on the same portion of the seabed, this non-intrusive method would be useful to assess the health condition and to identify any changes in any ecologically important habitats or areas, such as corals either in colony or community scale.

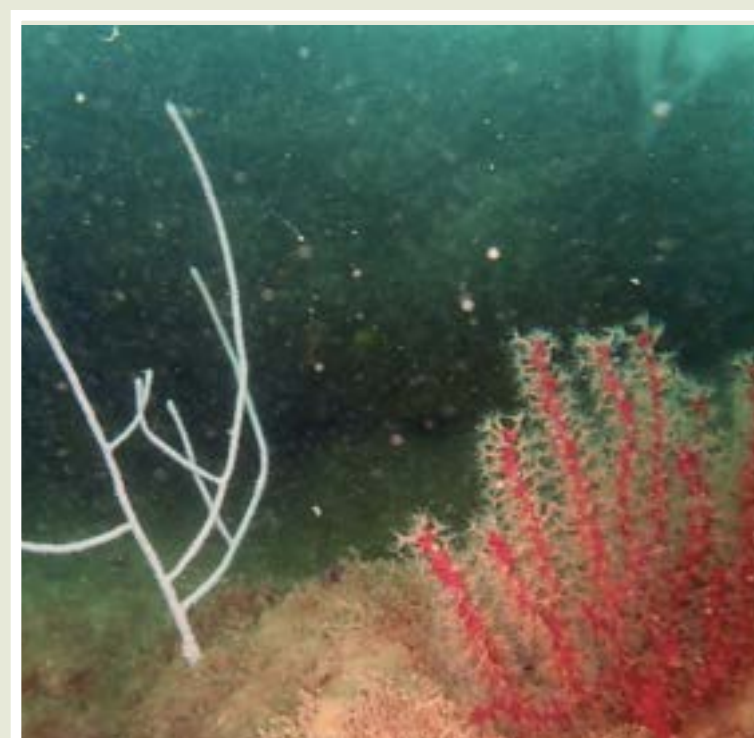# HARD CORAL IMAGES TAKEN BY SCUBA DIVERS
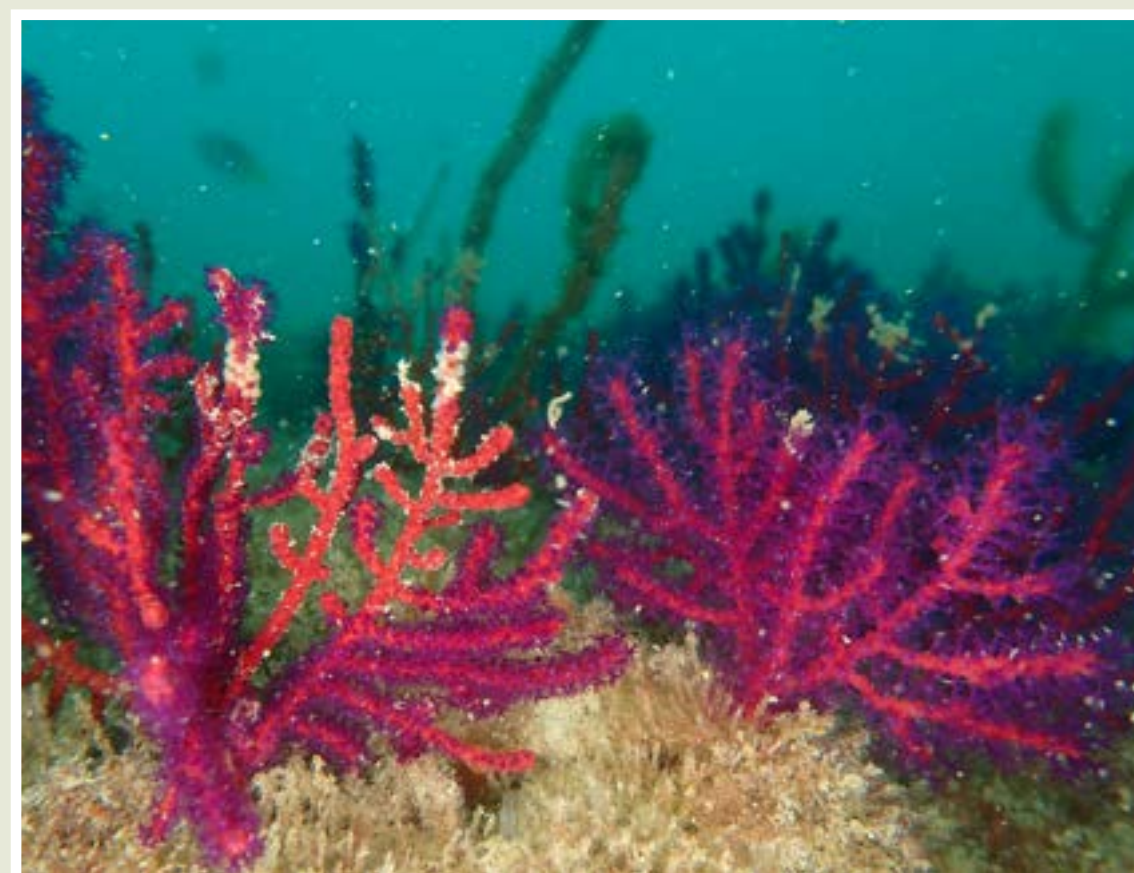

DIVING IN THE MARINE PARK

This section showcases the beauty of the underwater world of our study area – Tung Ping Chau Marine Park. SCUBA diving was conducted to capture some representative photos of the ecologically important habitats mapped in this study.
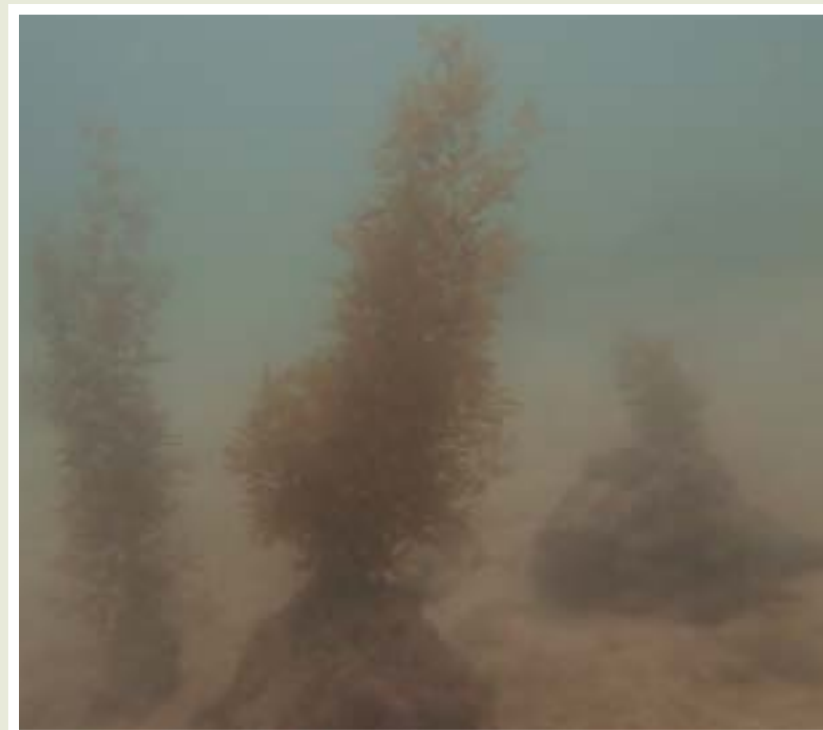
OCTOCORAL IMAGES TAKEN BY SCUBA DIVERS

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WAYFORWARD

The present study is the first underwater mapping project focusing on benthic ecology in Hong Kong. It helps to produce a detailed benthic habitat mapping protocol that is suitable for Hong Kong local waters and gather useful information for documenting and quantifying the key benthic habitats within TPCMP including hard corals, octocorals, black corals and macroalgae.

A combination of survey methods including acoustic surveys and optical validation by means of airborne unmanned aerial vehicle, drop camera and water drone were used for mapping the distribution and coverage of the important benthic habitats. The mapping results also re-affirmed the ecological importance of TPCMP.

It is envisaged that the habitat map produced in this study can be useful in public education for habitat protection, as well as further enhancing the long-term monitoring plan and prioritizing conservation effort in TPCMP. Habitat change can be monitored over time for facilitating management planning.