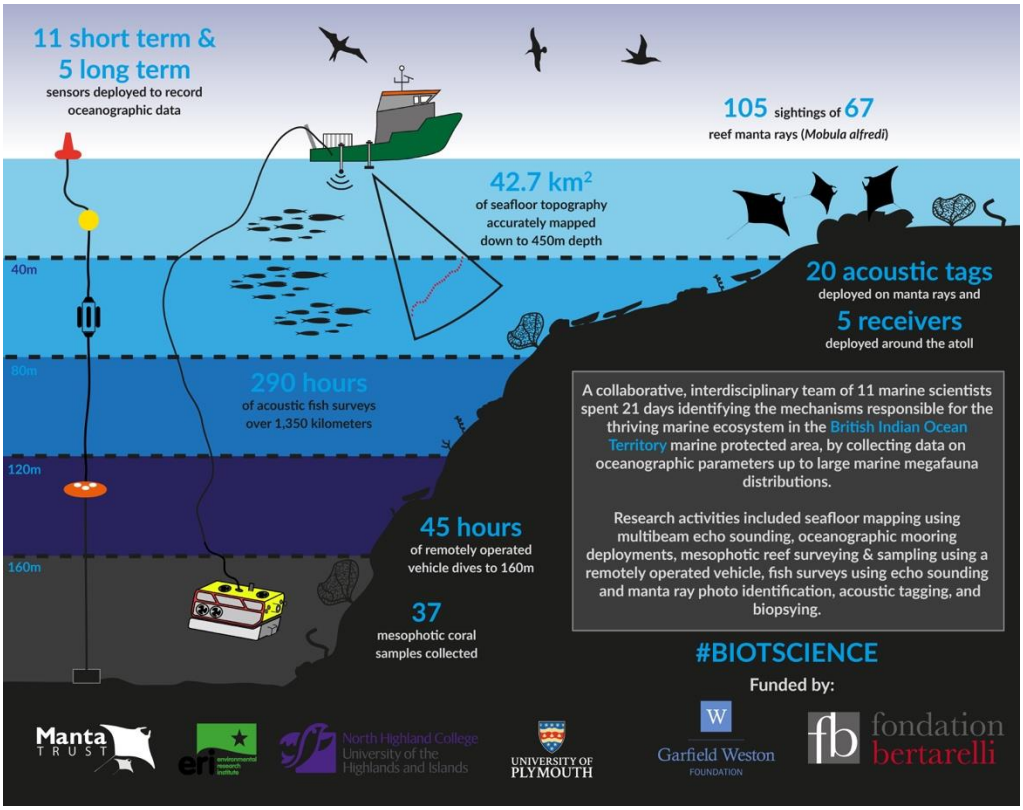
SUMMARY OF UNIVERSITY OF PLYMOUTH BIOT EXPEDITION, NOVEMBER 2019

The University of Plymouth team, comprising 9 scientists with expertise in physical oceanography, mesophotic reefs, fisheries acoustics, manta ecology and seafloor mapping, undertook their first expedition to BIOT between November 11th – December 7th, 2019. The expedition represented the team's first field effort in BIOT as part of their project co-funded by the Garfield Weston and Bertarelli Foundations. The team were further accompanied by Simon Hilbourne from the Manta Trust, Benjamin Williamson from the University of Highlands and Islands, and Katherine Robinson from Torquay Hospital (as expedition medic) and conducted operations aboard the *MV* Tethys Supporter based in Victoria, Seychelles.

Without exception, the team exceeded all expectations for the acquisition of data during the 21 day cruise. The highlights are illustrated in the infographic below but the key achievements include:

- A complete survey, with triplicate repeat surveys, to a depth of 160 m of the mesophotic reef community off Ile de Rats, Egmont, in addition to a complete survey of 'Manta Alley' on the north shore
- Collection of 37 coral samples from the mesophotic reef for genetic analysis
- Deployment of 20 acoustic tags and 5 receivers at Egmont alongside sightings of 67 reef manta rays
- Comprehensive, survey-grade multibeam bathymetry surveys to a depth of 400 m of Sandes seamount, Egmont Island, and the western half of Salomon Island
- Deployment and recovery of comprehensive mooring arrays over Sandes and Egmont to resolve how internal waves aggregate biomass and cause zonation in the mesophotic reef community
- Extensive surveys (>290 hours) of fish aggregation over the flanks of Sandes and Egmont, including 2 continuous 24 hour surveys (one over Sandes, one over Egmont) combined with vessel-based physical oceanographic measurements.



The success of the mission was notable against the backdrop of poor weather during the first 2 weeks; the transit south from Gan in particular was characterised by rough seas that prohibited the anticipated equipment preparation aboard the vessel. However, the determination of the crew and scientists to find

solutions to the adverse weather resulted in unexpected successes, most notably in the extensive remotely operated vehicle (ROV) surveys conducted in the shelter of Ile de Rats at Egmont Island.

The vessel used for this research expedition, the ***MV* Tethys Supporter**, proved to be pivotal in our success. Whilst significant effort had been made to plan the expedition in light of the limitations of a relatively small vessel (36 m length compared to 69 m for the Grampian Frontier for example), the achievements of the science team were unexpectedly **enabled** by the vessel's capabilities rather than being achieved despite them. Through a genuinely collaborative approach to working with the crew in a collegiate manner, the science team were superbly assisted at all stages by a generally competent and supportive crew with whom the science team forged a strong relationship. Special mention should be made of the captain, Craig Henn, who at times single handedly acted as engineer, ship driver and overall host. Without his endurance, problem-solving mentality and overall outstanding ability across all areas of the operation, the cruise would have not achieved such a high level of success. Beyond individual roles, specific aspects of the vessel that proved instrumental included:

- The Tethys' shallow draft enabled us to work in depths that required surveying within 50 m of the reef. No other vessel will approach within several hundred metres of the reef and as such would not allow us to conduct the multibeam surveys, the mooring deployments, nor the ROV surveys of the mesophotic reef. Simply stated, the key highlights of this expedition could only have been achieved aboard the Tethys because it is the only vessel able to operate close enough to the reef.
- The pole mounts enable the mounting of the multibeam (for seabed mapping), USBL (for locating the ROV), fisheries acoustic echosounder (to map the distribution of fish and plankton throughout the water column) and vessel mounted ADCP (for measuring currents from the ship). No other vessel offers the ability to mount the acoustic equipment and would thereby prohibit any seabed mapping, ROV operations, biomass mapping, or underway physical oceanographic measurements to be made.
- Installation of the A-frame and a substantial deck winch significantly improved the safety and ease of mooring and ROV deployment and recovery. Similarly, the relatively low deck reduces the vertical distance that heavy items (e.g. the ROV, mooring anchors etc.) need to travel during recovery and deployment, minimising the extent to which they swing on a rolling platform and reducing risk to personnel and equipment.
- The accommodation aboard, whilst basic, is sufficient for a multidisciplinary expedition that requires a variety of tasks to be achieved involving heavy lifting and small boat operations. The installation of a purpose-built container was critical in providing the specialist work space, particularly for the ROV operations but otherwise, a team of 12 was able to be accommodated in sufficient comfort for an extended cruise.
- The single goal of the vessel operator is to enable the science team to achieve their objectives. This single-minded priority provides absolute flexibility in conducting operations on a 24 hour basis, maximising the efficiency of operations onboard the vessel. We approximate that <24 hours were lost to down-time during the expedition, and that is despite suffering a failure of the steering motors that was rectified within 12 hours and had minimal impact on operations.

In light of the success of the expedition, and based on our science plan that requires the monitoring of changes in ecology and oceanographic processes throughout the year, we plan to undertake a second expedition to BIOT in March 2020. For the reasons stated above, the Tethys Supporter represents the only viable platform to achieve our goals which will include the recovery of the long-term moorings at Sandes and Egmont (where only the Tethys will be able to reach the position of the moorings due to the steepness of the seabed slope) and the acoustic receivers which are located in shallow water depths and require use of the deck winch due of the anchor weights that prohibit recovery by hand.

Limitations of the Tethys Supporter are the lack of Dynamic Positioning that would enable ROV operations in water depths where anchoring is not possible. The possibility of installing a DP system has been raised and could be pursued if it were deemed to offer significant advantages to future operations.

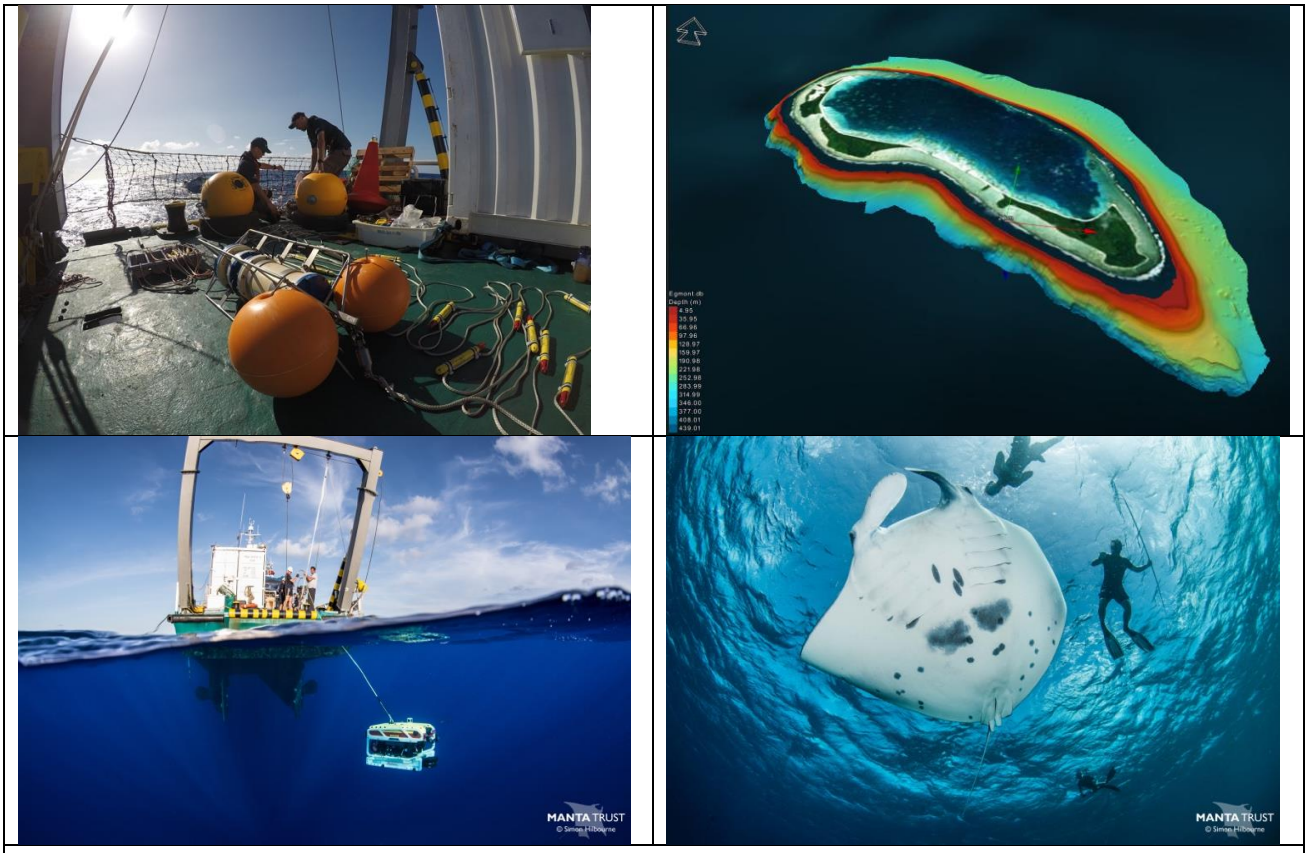


Figure 1. (clockwise from top left) Preparation of oceanographic moorings on deck of the Tethys Supporter, multibeam depth chart of Egmont, tagging of reef manta at Egmont, and deployment of ROV.