Successful use of a remotely operated vehicle to survey deep-reef habitats for white teatfish (*Holothuria fuscogilva*) in Torres Strait, Australia

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Abstract

A field survey of sea cucumber species of eastern Torres Strait, Australia was recently undertaken, in order to inform stock size estimates and distribution data for the Torres Strait beche-de-mer fishery. We also surveyed deep-reef (>20 m) strata (equivalent to habitat) to investigate deep-reef sea cucumber populations of white teatfish (*Holothuria fuscogilva*) using a remotely operated vehicle. The underwater camera system proved very successful at observing sea cucumbers. Although we surveyed habitat down to 50 m, we did not observe white teatfish deeper than 37 m.

The information gathered during the survey will be used to delimit and quantify the deep-reef white teatfish population for Torres Strait.

Introduction

The Torres Strait beche-de-mer (BDM) fishery is a sea cucumber fishery on the Australian side of Torres Strait, north of Cape York. The fishery has two components: 1) the sandfish fishery that occurs on Warrior Reef and adjacent to the Papua New Guinea sandfish fishery, and 2) the eastern fishery that occurs in a 16,844 km^2 area of Torres Strait situated at its eastern extreme (Fig. 1). The eastern Torres Strait fishery contains about 1204 km^2 of shallow reef-top habitat, 185 km^2 of shallow reef edge (<20 m deep) habitat, and 600 km^2 of deep (>20 m) reef edge and deep lagoon habitat that accounts for about 64% of all the reefs in Torres Strait (Skewes et al. 2010).

A field survey of eastern Torres Strait sea cucumber species was undertaken during November 2019 and January 2020 in order to inform stock size estimates and distribution data for the fishery. Previous surveys of the Torres Strait BDM fishery have been undertaken in 2002, 2005 and 2009 (Skewes et al. 2004; Skewes et al. 2010), and were all restricted to <20 m due to diving regulations. Of interest for the recent survey was investigating the full extent of the distribution of white teatfish (*Holothuria fuscogilva*) in deeper (>20 m) habitats, in order to quantify total stock biomass and evaluate the potential for further sustainable development of this fishery.

An exploration of the deep-reef reef habitats for white teatfish was undertaken using a remotely operated vehicle (ROV). We were able to successfully survey 53 deep-reef transects for the first time for the Torres Strait BDM fishery.

Methods

A DTG3 Deep Trekker ROV unit was modified and used to complement existing sea cucumber survey methods for Torres Strait. This involved deployment from a 5.0 m inflatable Naiad vessel, as well as handling the ROV in conditions of swell, wind and inclement weather (Fig. 2).

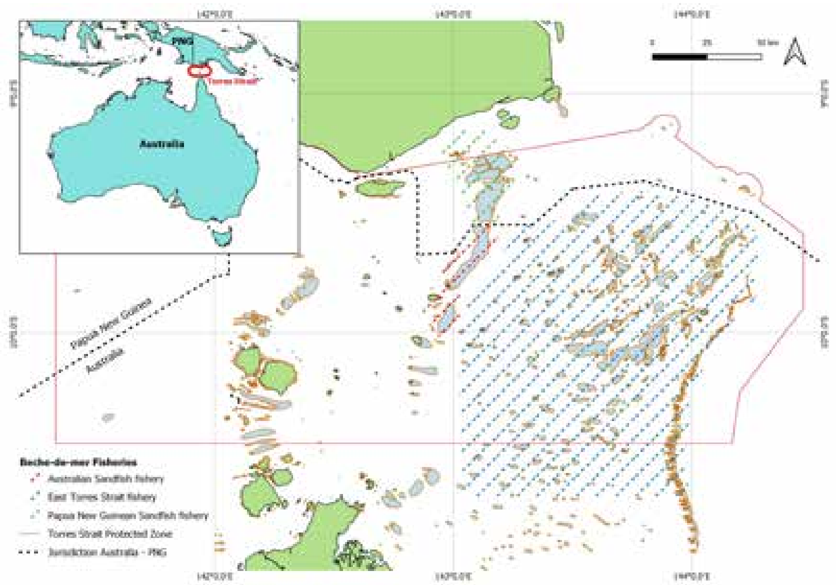

Figure 1. Approximate location of the three sea cucumber fisheries in Torres Strait, Australia.

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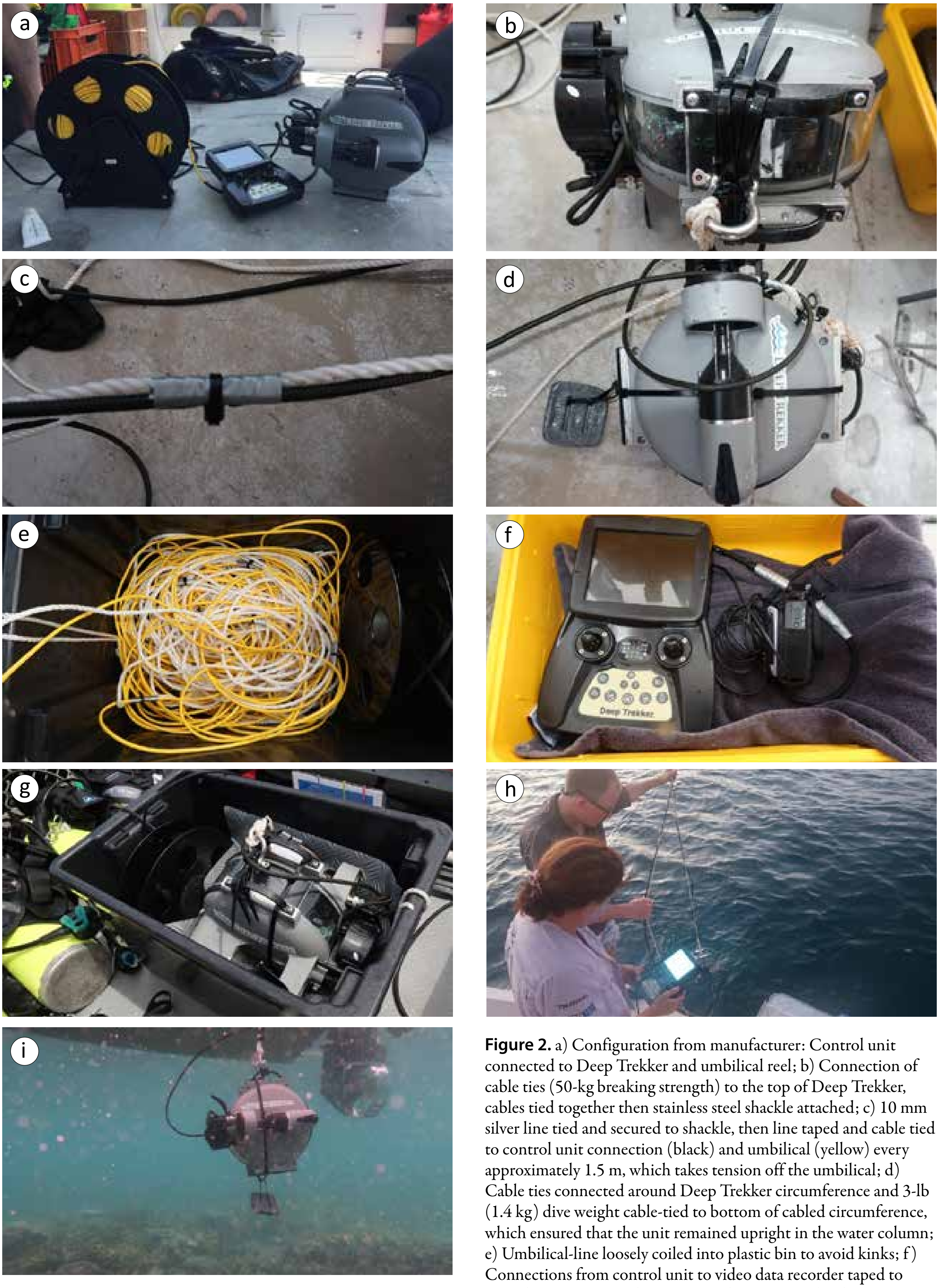

Figure 2. a) Configuration from manufacturer: Control unit connected to Deep Trekker and umbilical reel; b) Connection of cable ties (50-kg breaking strength) to the top of Deep Trekker, cables tied together then stainless steel shackle attached; c) 10 mm silver line tied and secured to shackle, then line taped and cable tied to control unit connection (black) and umbilical (yellow) every approximately 1.5 m, which takes tension off the umbilical; d) Cable ties connected around Deep Trekker circumference and 3-lb (1.4 kg) dive weight cable-tied to bottom of cabled circumference, which ensured that the unit remained upright in the water column; e) Umbilical-line loosely coiled into plastic bin to avoid kinks; f) Connections from control unit to video data recorder taped to provide protection and prevent pinching. Control-video system placed in waterproof Pelican™ case; g) The Deep Trekker was placed on a rubber mat on top of the umbilical for transport - stopped entanglement or damage from sea conditions; h) Trial deployment and video recording from control unit; i) Observing Deep Trekker underneath the Naiad vessel to determine the field of view. (images: N.E. Murphy)

Figure 3. Undertaking a survey transect from the Naiad vessel. (image: N.E. Murphy)

The Deep Trekker was used in a drop camera mode, where the ROV was negatively weighted and deployed from the vessel with a cabled tether and allowed to drift (or slowly towed) to collect data along transects undertaken from the Naiad vessel, for a set time (Fig. 3). Of note for the Deep Trekker was the controlled rotational capability and the 270-vertical-degree view that allowed for inspection of potential targets, as well as the capability to record high-quality video.

Set up

Undertaking transects

For deep-reef transects (>20 m), the unit was deployed into the water and lowered to within 1 to 2 m of the sea floor. The video was switched on to record, and 10-minute drifts were undertaken, with one person viewing the control unit, another tending to the umbilical (by raising the ROV up or down manually to follow the seabed), a third person recording information on a datasheet (including targets timestamp and depth, GPS location and distance along transect), and a fourth person controlling the Naiad vessel. Transect depths ranged from 20 to 50 m, and were 40 to 675 m long.

Observations were made in real time. The number of sea cucumbers seen and any significant habitat observed were recorded on a sampling datasheet, together with depth and time. All recorded video was reviewed to verify sea cucumber identification and total number. Habitat information was also updated on transect datasheets.

Field of view

The Deep Trekker field of view was determined by placing an object of known length on the transect and capturing it on video, with a diver in the water also taking measurements. Several images were used (after review) for comparison and assessment.

Outcomes

The white teatfish survey was exploratory and highly targeted. Deep-reef sites included sites adjacent to shallow reef edges, continuing down the reef slope, and in the deeper lagoons of the sunken northeasterly reefs of Torres Strait.

The DTG3 Deep Trekker ROV proved very successful at observing and quantifying sea cucumbers, including white teatfish. Although we surveyed habitats down to 50 m, we did not observe white teatfish deeper than 37 m. The average density of white teatfish in deep-reef habitats was the highest of any of the sampled strata (Fig. 4), at about 14 per hectare. Given the extent of the deep-reef habitat in east Torres Strait, the white teatfish in this habitat accounted for 72% of the entire white teatfish population in the area.

We are confident we have now delimited and quantified the deep-reef white teatfish population of eastern Torres Strait.

Acknowledgments

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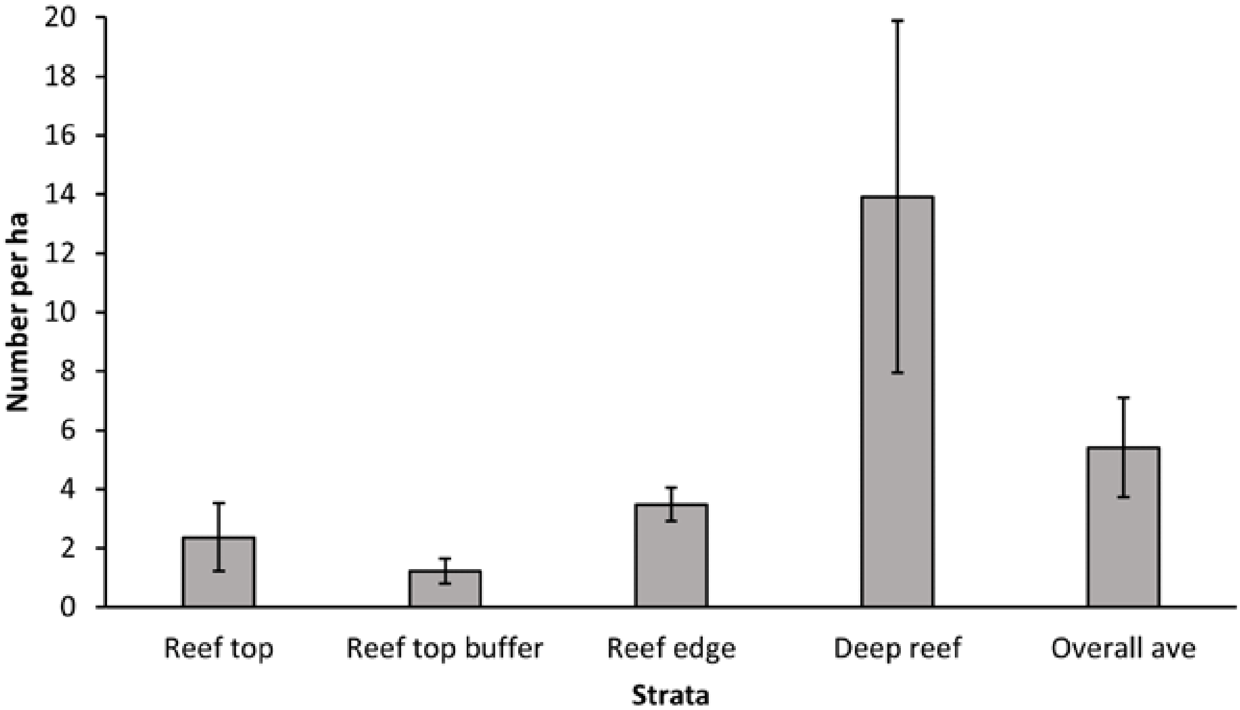

Figure 4. Density (number per hectare) of white teatfish (*Holothuria fuscogilva*) in four reef strata (habitats), and the overall stratified density for eastern Torres Strait (ave = average; error bars = one standard error).

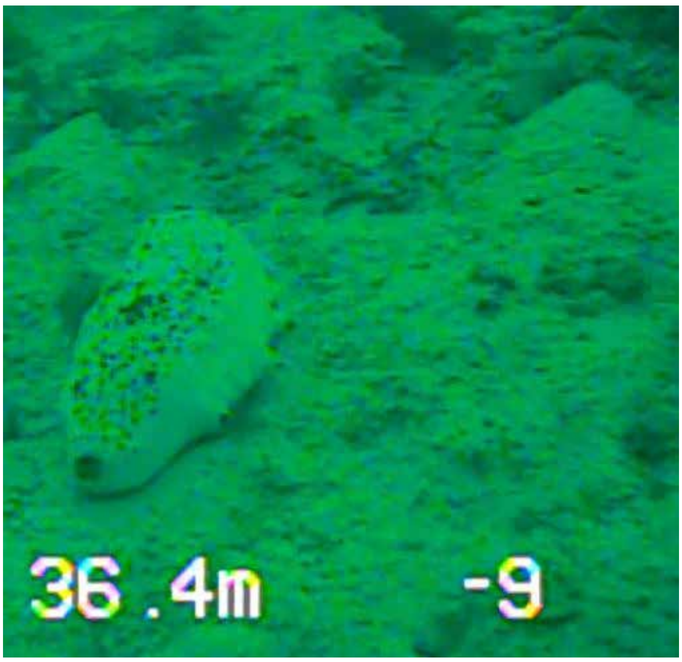

Figure 5. White teatfish (*Holothuria fuscogilva*) seen on underwater video transect. (image: N.E. Murphy)