Notes on the distribution and abundance of white teatfish – *Holothuria fuscogilva* Cherbonnier, 1980 – at White Island, Philippines

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Abstract

The white teatfish, *Holothuria fuscogilva*, is a vulnerable, commercially important sea cucumber in the Indo-Pacific region. Information on its distribution and abundance are important inputs for effective resource management. This study was conducted to locate white teatfish in the surrounding area of Medano White Island Marine Fish Sanctuary in Mambajao, Camiguin. In total, 21 white teatfish individuals weighing 0.6–2.1 kg were observed during 10 surveys from January 2020 to October 2020, and in November 2021. Density was found to be 2 individuals/ha. Knowing the occurrence of this species in the area is vital, considering that viable populations are only reported from Lopez Jaena, Misamis Occidental. The substrate of the area shows an overall distribution towards finer grain size, with coarse sand (53.17%) as the dominant substrate type and a low (4.7%±0.34%) organic matter content. Water salinity ranged from 35.8 ppt to 37.2 ppt, with a maximum water temperature of 28°C. There is no active collection or trading of white teatfish in the province; thus, the sanctuary and its surrounding area are a potential source of broodstock for the species. This note will serve as reference to strengthen protection inside the sanctuary and in its buffer zone. Meanwhile, white teatfish stock delineation in Mindanao is ongoing.

Keywords: Sea cucumber, broodstock, marine protected area, conservation, management

Introduction

The white teatfish (*Holothuria fuscogilva* Cherbonnier, 1980) is a commercially important sea cucumber species collected for its high nutritional value (Chen 2003, 2004) and varied applications: it is a luxury food item in some countries, particularly in Asia (Conand and Byrne 1995; Bordbar et al. 2011; Purcell et al. 2013), used as artificial feeds (Bakus 1973), in cosmetic products (Poh-Sze 2004; Conand 2005), and in traditional medicinal practices because it is supposedly effective against asthma, rheumatism, hypertension, impotence, constipation, and cuts and burns (Wen et al. 2010; Bordbar et al. 2011). Hence, the demand for this species has greatly increased, resulting in overexploitation of natural stocks in traditional fishing grounds in many areas (Guzmán et al. 2003; Conand 2004; Toral-Granda et al. 2008; Anderson et al. 2011; Eriksson and Byrne 2013).

The importance of high-valued sea cucumbers such as the white teatfish has prompted the Philippine government to conduct nationwide surveys to determine their population status, including that of De Guzman and Quiñones (2013), which established the presence of the species' viable populations in the Capayas Island Marine Sanctuary in Lopez Jaena, Misamis Occidental. This project brought about the implementation of two other projects on the development of captive breeding and hatchery technology for *Holothuria fuscogilva* from Lopez Jaena, Misamis Occidental in 2017, and the current project on the ecology, biology and genetic diversity of *H. fuscogilva* in Mindanao.[4] One of the objectives of the project is to map potential sites for sourcing white teatfish broodstock and determine their status. Captive breeding and restocking of hatchery-produced white teatfish juveniles in the wild is one plausible action to enhance the natural stocks.

Sexual maturity of white teatfish is attained when it is about 32 cm in length or 700 g in weight (Conand 1981). These body sizes may be applied when searching for sea cucumber broodstock. Adults are often found in deep areas of the reef, while juveniles can be found in shallow seagrass beds (Lumasag et al. 2017; De Guzman and Quinones 2013). However, this species is often found in low densities in the marine environment. Hence, establishing monitoring sites for ecological and biological studies is a challenge. The limited number of broodstock that could be available in a given sampled area is also a main concern of the hatchery component of the center. While the best quality, hatchery-grown individuals can be kept to become broodstock, this strategy requires long-term planning and considerable investment. In general, a significant portion of broodstock continues to come direct from wild-capture fisheries. Many hatcheries seek to obtain wild broodstock to diversify the genetic makeup of their stocks.

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[4] This project is funded by the Philippines Department of Science and Technology under the "Accelerated R&D Program for Capacity Building of Research and Development Institutions and Industrial Competitiveness" of the Science for Change Program, Niche Centers in the Regions for R&D.

The Medano White Island Marine Fish Sanctuary in Barangay Agoho, Mambajao, Camiguin Province was one of the areas in Mindanao that was surveyed, and where the surrounding area was found to have a potentially viable population of white teatfish. The 37.74 ha sanctuary was established through Municipal Ordinance No. 3, Series of 2000. Although there is no active collection or trading of white teatfish in Camiguin Province, there is also no available information on its population. Hence, this short article aims to present observations from an underwater survey in Camiguin Province, highlighting the possibility of the province being a potential source of broodstock.

Methodology

Study area

The Medano White Island Marine Fish Sanctuary in Barangay Agoho, Mambajao, Camiguin is located near an uninhabited sandbar within the municipality's designated White Island Marine Park, which is 1.4 km north of Camiguin Island in the Bohol Sea (Fig. 1). The exposed part of the island consists entirely of sand and has no fixed shape due to the tides and currents driven by monsoonal changes. The waters around White Island are known for strong currents due to the rising of the sandbar from the sea bottom, which causes the currents to flow swiftly around it. The sanctuary is a strip of protected area in the northeastern portion of the islet. Currents are strong on either side of the sanctuary, but conditions can be relatively calm in the middle.

Data collection and sampling

Ten surveys were intermittently conducted from January to October 2020 and in November 2021 to locate white teatfish in the surrounding areas of Medano White Island Marine Fish Sanctuary. Collected individuals were photographed using the Olympus Tough TG-5 underwater camera, after which they were measured in terms of their gravimetric body length, width and weight. The temperature and salinity of the water were analyzed *in situ*. Sediment samples were collected to a depth of 10 cm using a PVC corer with a diameter of 6 cm. For grain size analysis, 10 samples of clean sediments (each with 80–100 g dry weight) were subjected to dry sieving using a stack of Wentworth-grade sieves within the range of 4000–31 µm. Sieved samples were pooled (composite) and grain size classification was based on Wentworth (1922). A simple estimate of the organic content of sediments was derived from the mass of the loss on ignition combusted at 450°C in a muffle furnace (Eleftheriou 2013). Other sea cucumber species found in the surveyed site were also recorded and counted.

All sampled individuals were marked to avoid recapture by removing a small piece of skin tissue at the posterior dorsal portion of the body and released back to the general area where they were collected. No marked individuals were recaptured, implying that the survey area was within a larger area in which individuals of white teatfish moved around.

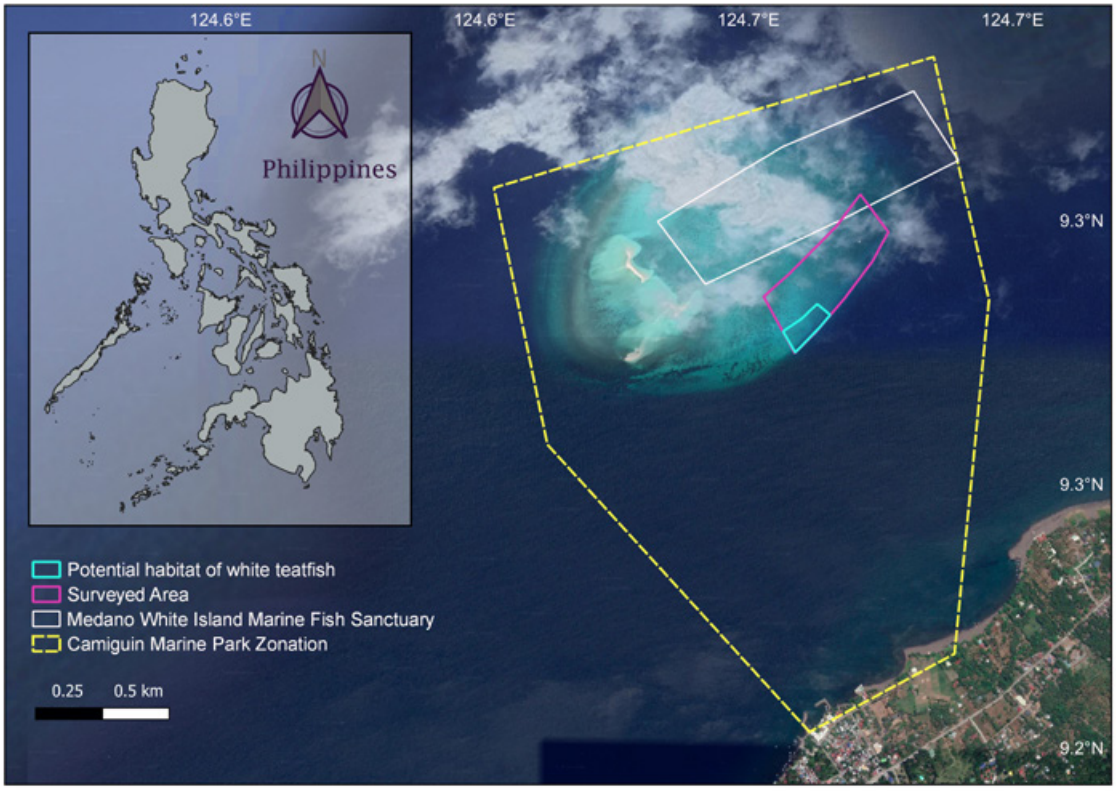

Figure 1. The geographic location of the surveyed area in Mambajao, Camiguin. Source: Adapted from Google Earth 2020

Results and discussion

An initial underwater scoping survey was conducted within a total area of 11 ha at a depth of 4–18 m that included the southern half of the sanctuary, and in which one individual of white teatfish of adult size was encountered (Fig. 2). This area was found to include zones where substrate conditions were unfavorable for white teatfish. Within this area, only 12.18%, or 1.34 hectares, were within the preferred habitat range of the species, which was where the individual was found. This area was a sandy slope of the south-southeastern part of the sanctuary at a depth of 6–11 m. Overall, the 10 intermittent surveys have a computed density of 2 individuals/ha. Although this figure is much lower than the density of 2130/ha reported for the Gulf of Aqaba in the Red Sea (Hasan and Johnson 2019) or 147 individuals/ha for Lopez Jaena in Misamis Occidental in the Philippines (De Guzman and Quinones 2021), it is comparable to those reported for Tubbataha at 1.04 individuals/ha (Dolorosa 2015) and Tonga at 1.66 individuals/ha (Shedrawi et al. 2020).

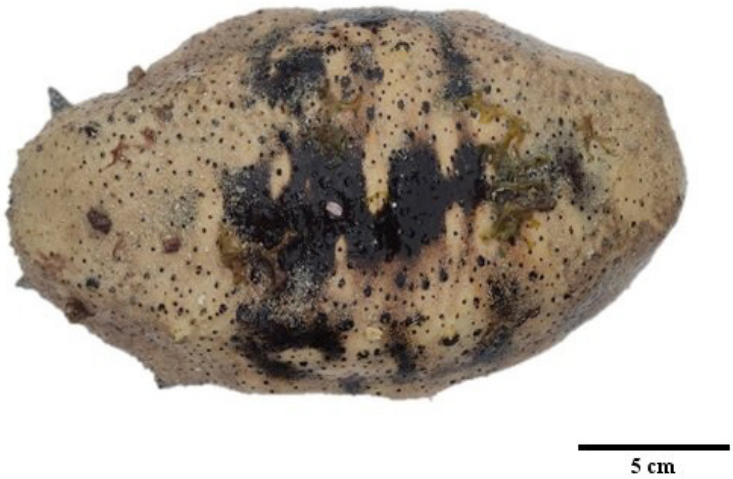

Figure 2. Dorsal view of a white teatfish, *Holothuria fuscogilva*, found in the surrounding area of Medano White Island Marine Fish Sanctuary. Image: EBGen Project

The gravimetric data from all the sampled white teatfish individuals showed a body length ranging from 24 cm to 49.5 cm, body width ranging from 10.5 cm to 19.2 cm, and weight ranging from 600 g to 2060 g (Table 1). Given these values, the white teatfish in Camiguin can be used as broodstock because size at first maturity reported for this species is about 32 cm in length and 700 g in weight (Conand 1981; Preston 1993; Leopardas et al. 2021). As to their gonadal maturity, Leopardas et al. (2021) reported that white teatfish in Laguindingan, Misamis Oriental were mostly mature in the month of May with relatively high gonad output. Accordingly, size at first maturity and the period of broodstock collection should also be considered in any initiatives to manage the sea cucumber resource.

The presence of adult and sub-adult white teatfish in deeper areas is expected because relatively larger individuals tend to be found in greater depths compared to juveniles, which in turn would be expected to be found in shallower seagrass beds (Conand 1981; Reichenbach 1999; Kinch et al. 2013). The same observation was also recorded for the orange-footed sea cucumber *Cucumaria frondosa* (Conand 1981; Hamel and Mercier 1996) which undergoes progressive migration from shallow reef areas to deeper exposed sandy areas as the organism sexually matures. Hence, the observation that white teatfish juveniles are mostly found in shallower protected areas such as seagrass beds and then slowly migrate to reef areas as they mature is indicative of an analogous migration pattern for this species. This notion is supported by Ramofafia et al. (2000), where sexually mature individuals of white teatfish were recorded in water depths ranging from 25 m to 35 m. Similarly, size-related migration has also been observed in *Stichopus hermanni* (Conand 1993).

The substrate where the white teatfish individuals were found showed an overall gradient towards finer grain size distribution, with coarse sands as the dominant substrate type (Fig. 3), and with a low organic matter content of 4.7% ± 0.34%. These characteristics of sediments are also observed in habitats of white teatfish in other parts of Mindanao. Although it is reported elsewhere that substrates of sea cucumbers can have organic matter levels as high as

Table 1. Gravimetric data of white teatfish (n = 21) assessed in the surrounding areas of Medano White Island Marine Fish Sanctuary.

Physical characteristics	Mean	± STDEV	± SEM	Min	Max
Length (cm)	34.12	6.15	1.34	24	49.5
Width (cm)	14.11	2.33	0.52	10.5	19.2
Weight (g)	1392.33	389.85	85.07	600	2060

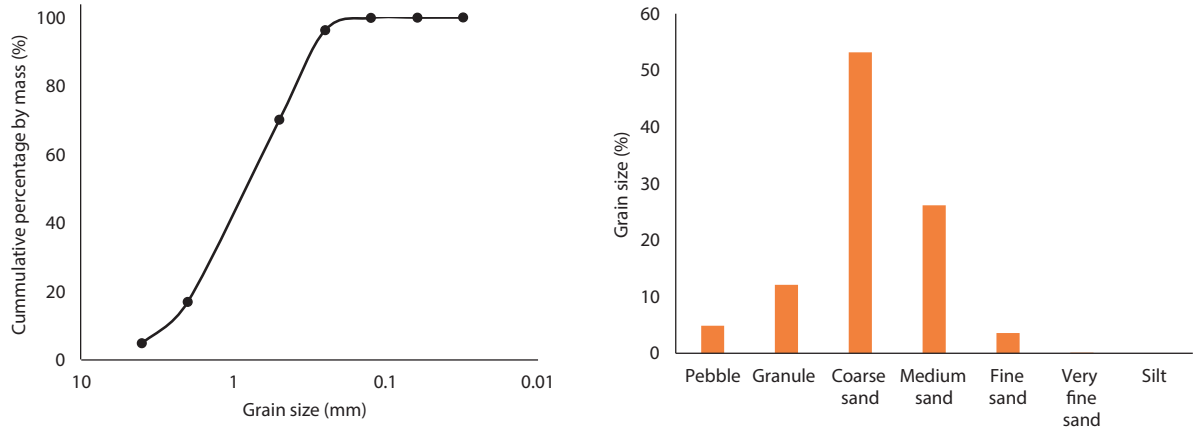

Figure 3. Grain size composition on the habitat in which white teatfish individuals were found at White Island, Camiguin.

30%, Mercier et al. (2000) reported that *Holothuroa scabra* prefers substrates with an organic matter content of less than 5%. Meanwhile, salinity in the area during sampling was 35.8–37.2 ppt, and water temperature was 28°C *in situ*. The findings were comparable to those of other reports on the habitat of the white teatfish across the Indo-Pacific, with the species commonly found to inhabit outer barrier reef slopes, reef passes and sandy areas in semi-sheltered reef habitats (Battaglene 1999; Asha and Muthiah 2002, 2005). Understanding the features of the sediment and water where white teatfish are found is essential since these factors can explain some variations in the growth and microhabitat preference of the species (Plotieau et al. 2014).

All white teatfish individuals recorded during the surveys were found in the surrounding area of Medano White Island Marine Fish Sanctuary. It is well recognized that marine protected areas play a key role in protecting many species from unregulated harvesting as well as in increasing species abundance in its adjacent areas through the spillover effect (Halpern 2003; Lubchenco et al. 2003; Norse et al. 2003; Russ et al. 2004). On the other hand, the rarity and dispersal of sea cucumbers in the different coastal habitats may be influenced by localized and/or climatic conditions, such as habitat types, shelter, sediment properties, and water depth. In terms of preference for microhabitat, seagrasses in general appear to provide sea cucumbers an appropriate substrate for larval settlement, burying actions, and water turbulence protection (Floren et al. 2021). Other factors affecting and regulating the distribution of sea cucumbers are coastal processes such as hydrodynamics, which influence the sediment granulometry and, thereby, define the niches of holothurians (Massin and Doumen 1986).

Recommendations

Given the occurrence of white teatfish, *Holothuria fuscogilva*, in the vicinity of the marine protected area, we recommend that the protection of the areas be strengthened, including that of the buffer zone. We also advocate for continued legal protection because the area could be a potential source of white teatfish broodstock for future captive breeding activities. Moreover, a more detailed survey is also necessary to fully understand the ecology, biology and genetics of the white teatfish in Camiguin vis-a-vis promoting public awareness of its importance en route to sustainable management and resource conservation.

Acknowledgements

This study is under the project "Ecology, biology, and genetic diversity of *Holothuria fuscogilva* Cherbonnier, 1980 in Mindanao" of the Accelerated R&D Program for Capacity Building of Research and Development Institutions and Industrial Competitiveness: Niche Centers in the Regions for R&D Program: Sea Cucumber R&D Center, funded by the Department of Science and Technology through its Grants-in-Aid Program (project code 3562). The project is also under the monitoring of the DOST- Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development. We are grateful to the Local Government Unit of Mambajao and the Provincial Government of Camiguin for the support provided in the conduct of the research. Special appreciation to Mindanao State University at Naawan for providing office and laboratory support, as well as administrative assistance.

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