TOLEDO INSTITUTE FOR DEVELOPMENT AND ENVIRONMENT

PORT HONDURAS MARINE RESERVE
QUEEN CONCH STATUS REPORT

2020

Toledo Institute for Development and Environment

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Central America

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1.0 INTRODUCTION

The Port Honduras Marine Reserve (PHMR) was established in 2000 with an area of 40,468 Ha and co-managed by the Toledo Institute for Development and Environment (TIDE). It is the southernmost marine protected area in Belize and extends approximately 8 km out to sea in the southern barrier lagoon. The PHMR includes a range of ecosystems from coastal wetlands to mid lagoonal reefs (a unique reef type along the Belize Barrier Reef). It also contains extensive seagrass beds and surrounds over 100 mangrove cayes (Wildtracks 2017). It supports important artisanal commercial fisheries for spiny lobster and queen conch, in southern Belize. It is an estuarine based protected area and serves as an important buffer between the southern mainland and the main barrier reef, with five majors watersheds exiting in the area.

The focus of this marine protected area is fisheries management with the majority of this marine reserve a general use zone (95%), open to fishing, where commercial, subsistence and recreational fishing are allowed. Four replenishment or no-take zones are designated (4%) around West, East and South Snake Cayes and West Cane Cayes, where non-extractive recreational activities are allowed. There is a preservation zone (1%), 0.8 km radius around Middle Snake Cayes, where only research activities are allowed (Figure 1) (Wildtracks 2017).

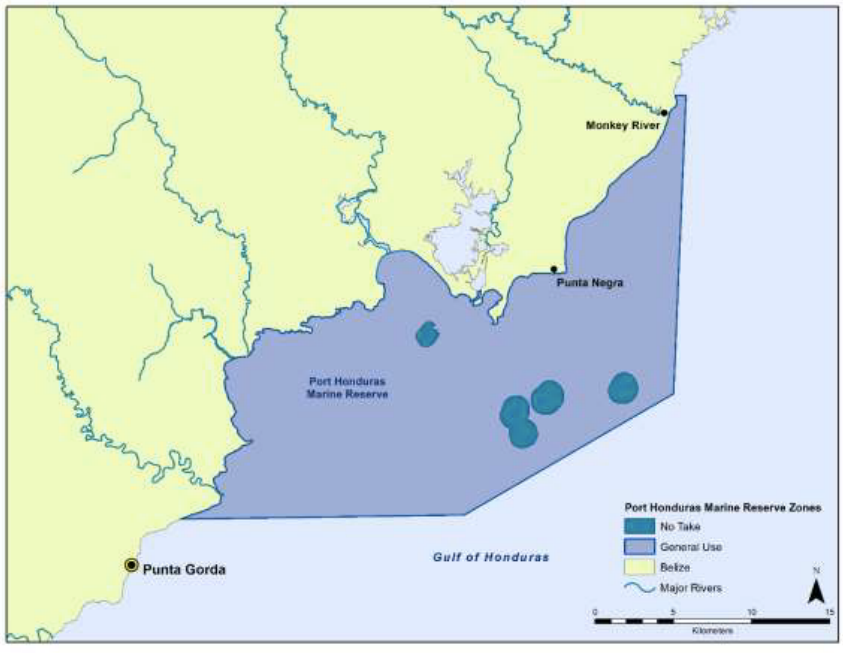

Figure 1 PHMR Zones, from the PHMR Management Plan 2017-2021 (Wildtracks 2017)

2.0 METHODOLOGY

Since 2004 TIDE has been monitoring the populations of the commercially important species, queen conch (*Lobatus gigas*), across twenty sites within the management zones of the marine reserve and a few outside, adjacent to the marine protected area (Figure 2). This long-term monitoring has produced information on population abundance, size and maturity of this important species. In 2013 TIDE produced a Benthic Commercial Species Audit 2009-2013 to inform adaptive management for Managed Access, which provided a comprehensive report on the health of commercially exploited species in the PHMR. In 2019, TIDE completed a comparative assessment on queen conch for the period 2009-2019 highlighting trends in population abundance, size and maturity as a means of assessing the effectiveness of the Managed Access as a fisheries management tool.

This current report gives an update for 2020 in comparison to 2019 results. Data was collected in mid-May 2020 after the close of the season (March 27th). Data collection followed previous methodology employed for queen conch, with five belt transects of 50 m by 4 m placed parallel to each other. On each transect the entire 200 m^2 area was searched and all conch encountered were counted and measured for shell length (SL), lip thickness (LT) and lip width (LW) (TIDE 2019). The surveys were conducted only once in 2020 due to logistical challenges with the completion of field sampling. For 2020, only twenty sites out of the twenty-one were surveyed, 7 within the replenishment zones (RZ), 9 in the general use zones (GUZ) and 4 outside the reserve (OUT) (Figure 2).

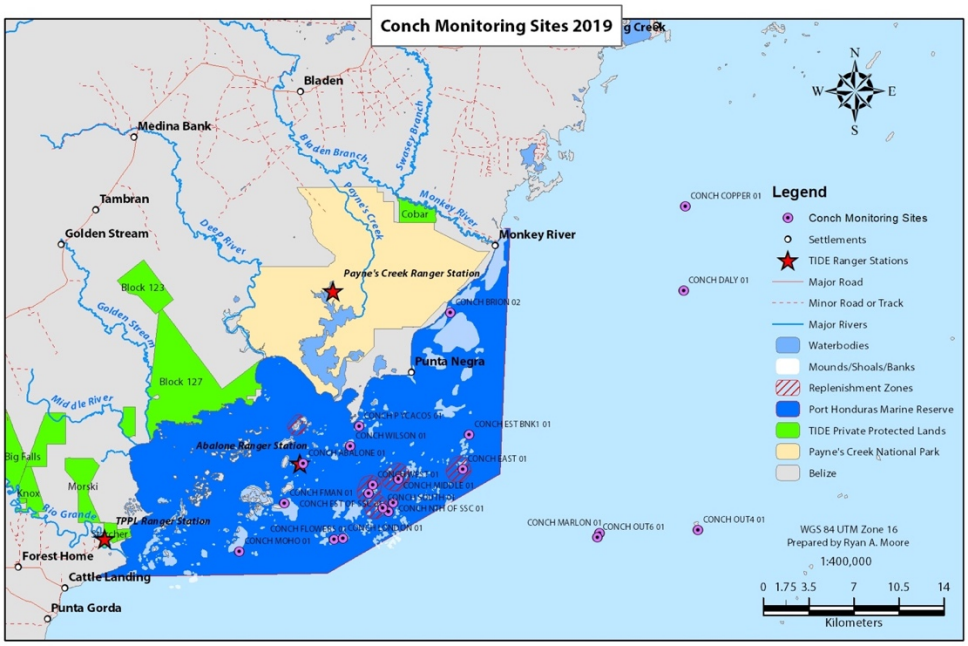

Figure 2 Queen conch monitoring sites within the PHMR and outside (TIDE 2019)

3.0 RESULTS

TIDE surveyed twenty (20) of its long-term monitoring conch sites between May 11-14th, 2020 about a month and a half after the season closed. The mean density found from these sites was 53.5 conch ha^{-1} with a mean shell length of 188.6 mm (±7.6 Standard Error, S.E.) and mean lip thickness of 3.9 mm (±1.3 S.E.). Of the twenty surveyed sites, three had no conch encountered and six sites had queen conch with no lips (Table 1). Habitats surveyed were a range of compositions including normal conch habitat of sand/seagrass, and sand/seagrass/coral or seagrass/coral. Other habitats surveyed included coral and sand, sparse coral, and coral rubble with gorgonians. Sediments ranged from sand to silt and mud.

Abundance of queen conch within the PHMR was fairly low with mean density of 53.5 per ha^{-1} with seventeen of the twenty sites having conch. The lowest density was 10 conch ha^{-1} found at South Snake Caye and Frenchman's Caye, and the highest density was 170 conch ha^{-1} at Flowers Bank and South Snake Caye - East (Figure 3). All replenishment zone sites had conch.

In regards to shell length (SL), for the sites that had conch, a majority had a mean shell length above the legal limit of 178 mm with six sites having mean SL less than the legal length (Figure 4). Sites with the three largest shell length were Marlon Bank, East Snake Caye and Moho Caye, between 225-253 mm. Sites with smallest shell length were Wilson Caye and West Snake Caye 1, 142-146 mm. A frequency distribution analysis of shell length (SL) showed a similar trend with roughly half of conch (55.1%) meeting the legal-size limit for shell length (Figure 5).

Data on lip thickness (LT) showed that 7 of the 11 sites with conch recorded with a flared lip, had a mean LT below 5 mm. Six of the sites had conch with no lips at all. Four sites: East Snake Caye, Marlon Bank, Moho Caye and South Snake Caye, had conch with mean LT >5 mm. The highest lip thickness was found within the replenishment zone at East Snake Caye, with a mean LT of 17 mm (Figure 6). Size distribution analysis of LT showed that 69% were juvenile conch with no lip, 16% were sub-adults (1-9 mm) and only 15% were adults above 10 mm LT (Figure 7).

When the data was compared by management zones, it was observed that the replenishment zone had the highest mean density of 58.6 conch ha^{-1} (±21.0 S.E) and the highest mean lip thickness (5.4 mm±2.8 S.E.) (Figure 8). Outside the reserve had the largest mean shell length (196.7 mm±25.9 S.E.). Mean shell length was lowest inside replenishment zones (179.8 mm±11.8 S.E) and mean density was lowest outside the marine reserve (50.0 ±30.8 S.E.) (Figure 8).

Data from 2020 was compared with previous years using TIDE's 2019 Port Honduras Marine Reserve Benthic Commercial Species Update Report. Based on 2019's data, conch was either similar or more abundant in 2020 in all the management zones (Figure 9), with a general upward trend. Shell length and lip thickness however were lower in 2020 than previous years, with mean shell length of between 200-230 cm in the three zones in June 2019, versus 179-197 cm in May 2020; and mean lip thickness of 4-11 mm in June 2019 versus 3.0-5.4 mm in May 2020 (Figures 8, 10 and 11).

Note that these results were all at the end of the conch fishing season and reflect population trends exposed to exploitation. Since there were no surveys done at the end of the closed season, when some recovery and recruitment into the area is expected, no data was available for comparisons on potential increases in abundance or population structure, in the absence of fishing pressure.

Table 1 Summary of Shell Length (SL), Lip Thickness (LP), abundance and density (ha^{-1}) from twenty long-term monitoring sites in the Port Honduras Marine Reserve

SITES	Mean SL (mm)	Mean LT (mm)	Abundance	Density (ha^{-1})
Abalone Caye	194.8	2.1	9	90
Brion Bank			0	0
Copper Bank			0	0
Daly Bank	151.7	0.0	3	30
East Snake Bank			0	0
East Snake Caye	225.3	17.1	9	90
Flowers bank	197.6	1.0	17	170
Frenchman Caye	204.0	0.0	1	10
London Bank	192.7	3.3	9	90
Marlon Bank	253.3	7.7	3	30
Middle Snake	152.0	0.0	5	50
Moho Caye	225.0	10.5	2	20
OUT 4	185.0	1.3	14	140
Punta Ycacos	200.0	2.3	3	30
South Snake Caye	210.0	14.5	1	10
South Snake Caye - East	165.3	0.0	17	170
South Snake Caye - North	199.5	2.0	2	20
West Snake Caye 1	146.7	4.0	3	30
West Snake Caye 2	160.0	0.0	4	40
Wilson Caye	142.8	0.0	5	50
MEANS	**188.6**	**3.9**	**5.4**	**53.5**
STANDARD DEVIATION	**31.5**	**5.4**	**5.4**	**54.1**
STANDARD ERROR	**7.6**	**1.3**	**1.2**	**12.1**
SL=Shell Length				
LT=Lip Thickness				

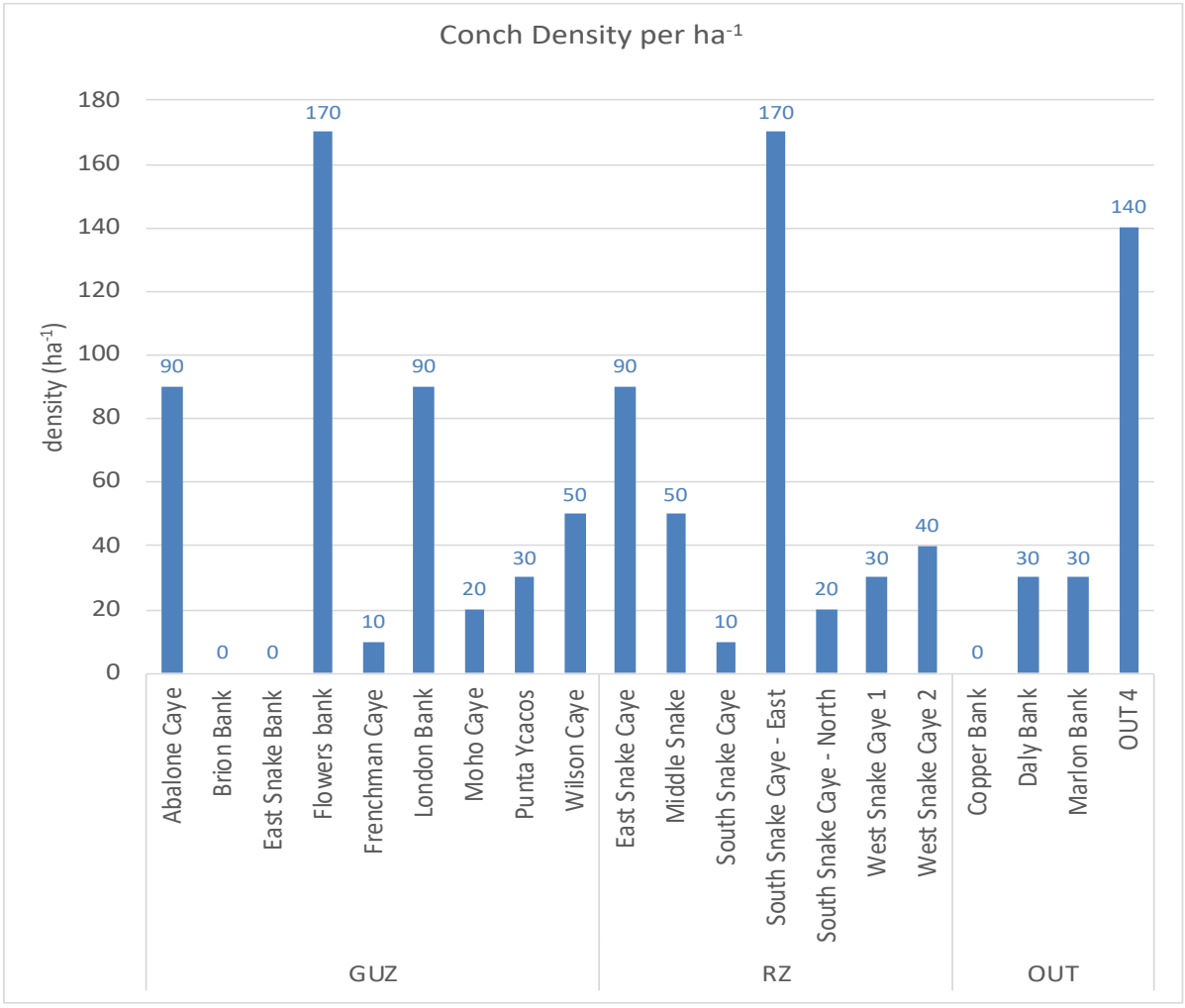

Figure 3 Abundance of queen conch ha^{-1} at the twenty sites surveyed within the PHMR in 2020 (GUZ-General Use Zone, RZ-Replenishment Zone, OUT-Outside Reserve)

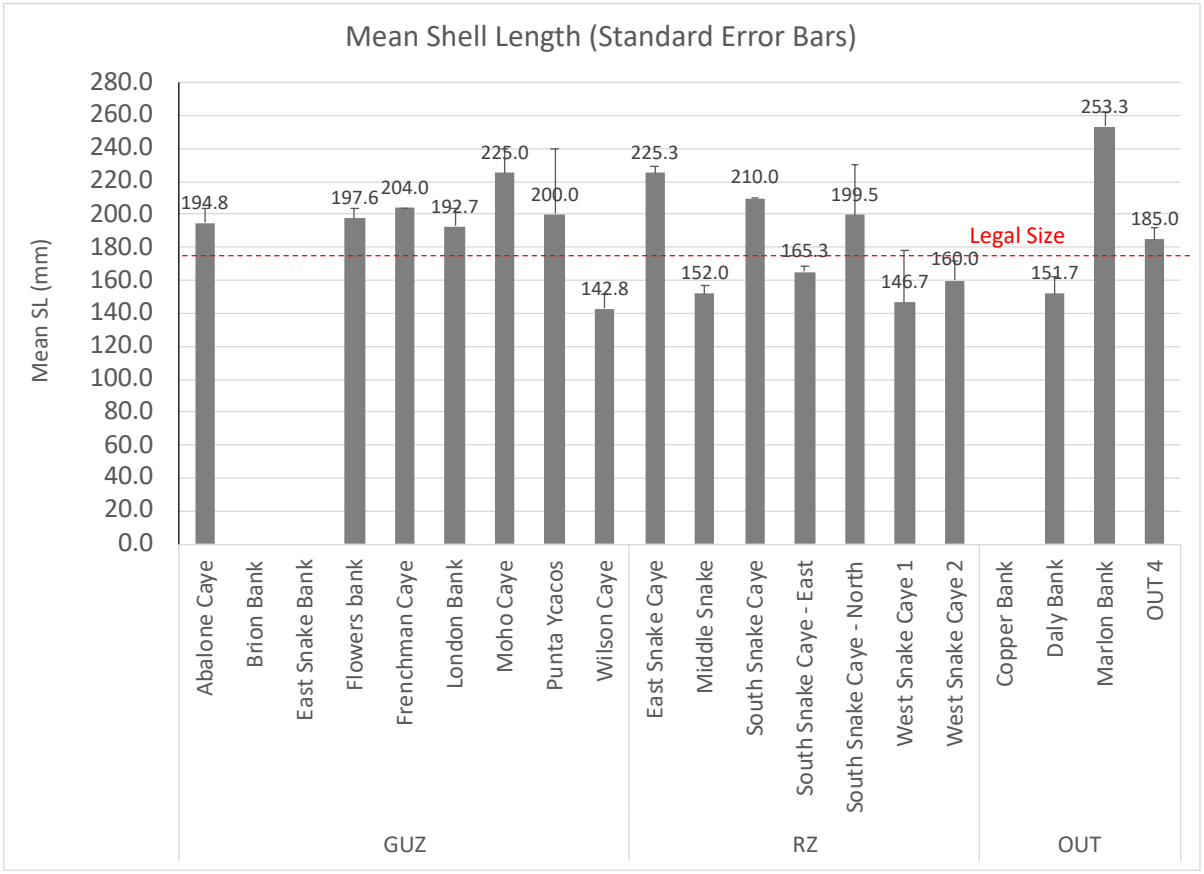

Figure 4 Mean shell length (SL) in mm of queen conch surveyed at sites within the PHMR (GUZ-General Use Zone, RZ-Replenishment Zone, OUT-Outside Reserve) (±Standard Error Bars, S.E.)

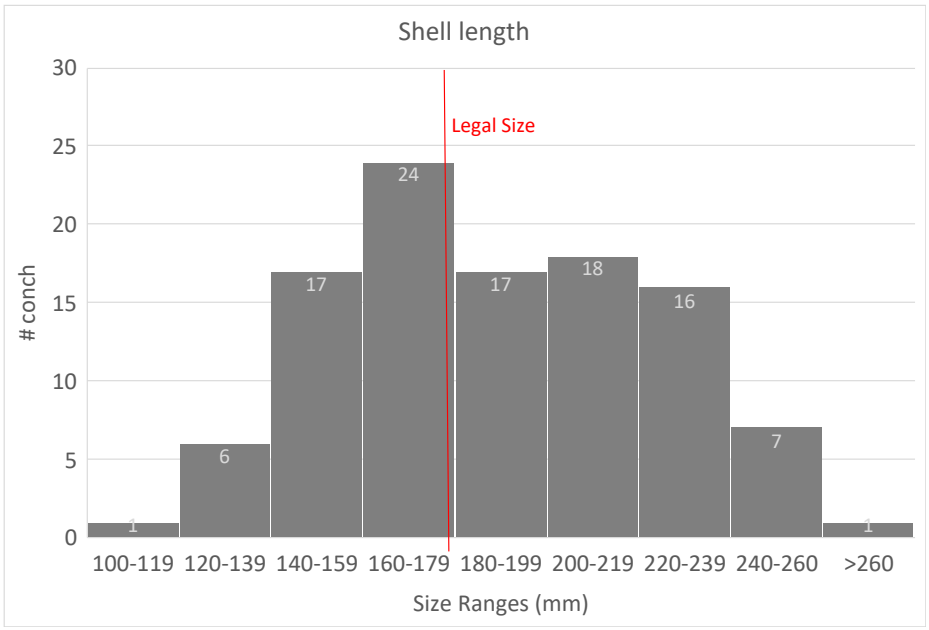

Figure 5 Size frequency distribution of shell length (SL) in mm for all queen conch surveyed within the PHMR

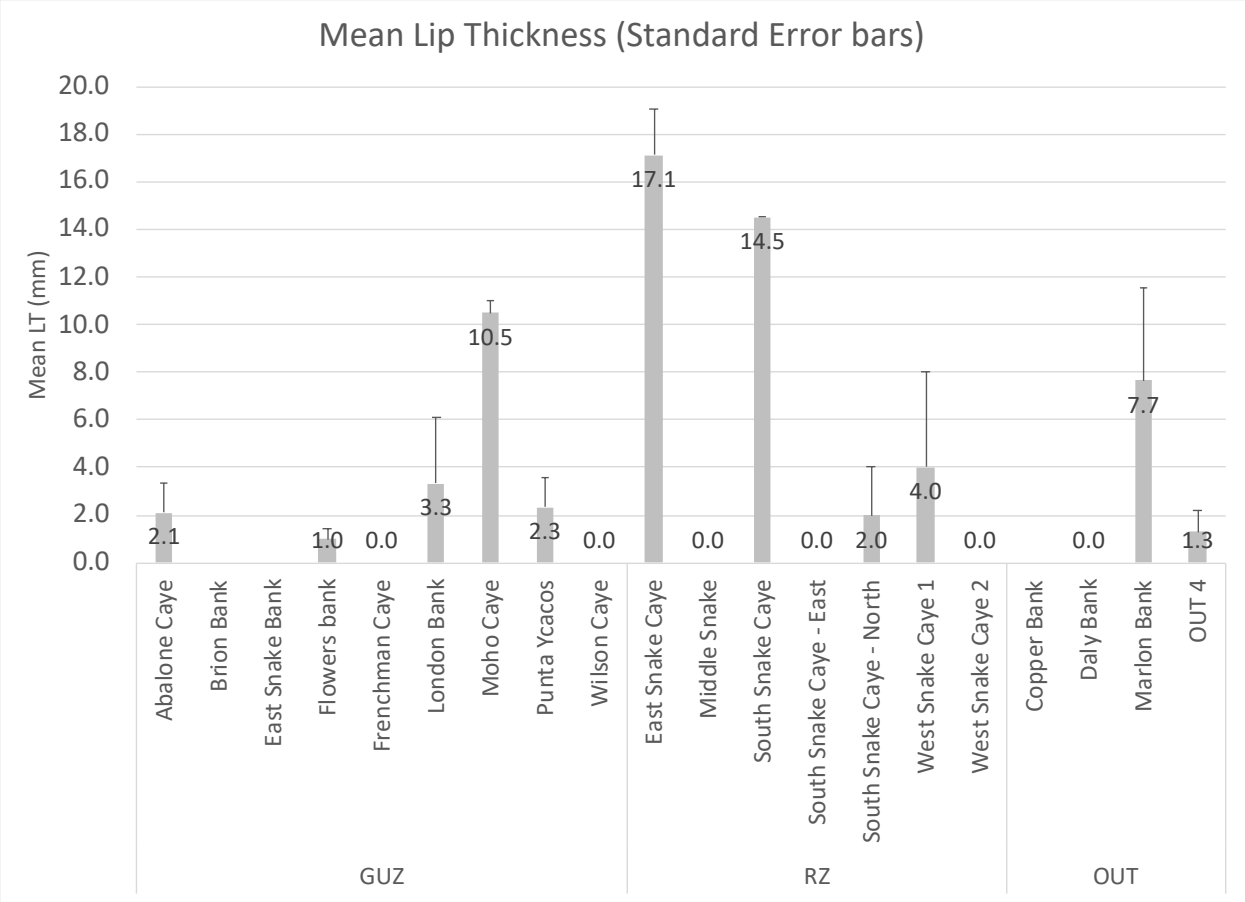

Figure 6 Mean lip thickness (LT) in mm of queen conch surveyed at sites within the PHMR (GUZ-General Use Zone, RZ-Replenishment Zone, OUT-Outside Reserve) (±Standard Error Bars, S.E.)

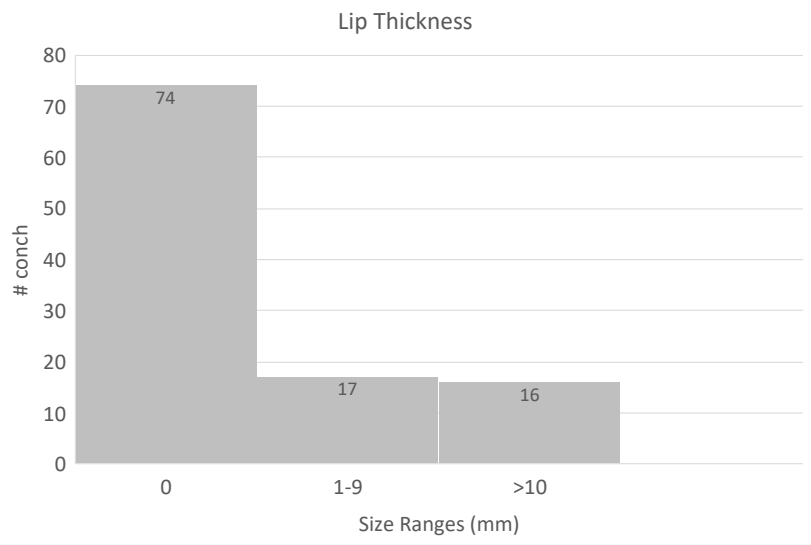

Figure 7 Size frequency distribution of lip thickness (LT) in mm for all queen conch surveyed within the PHMR

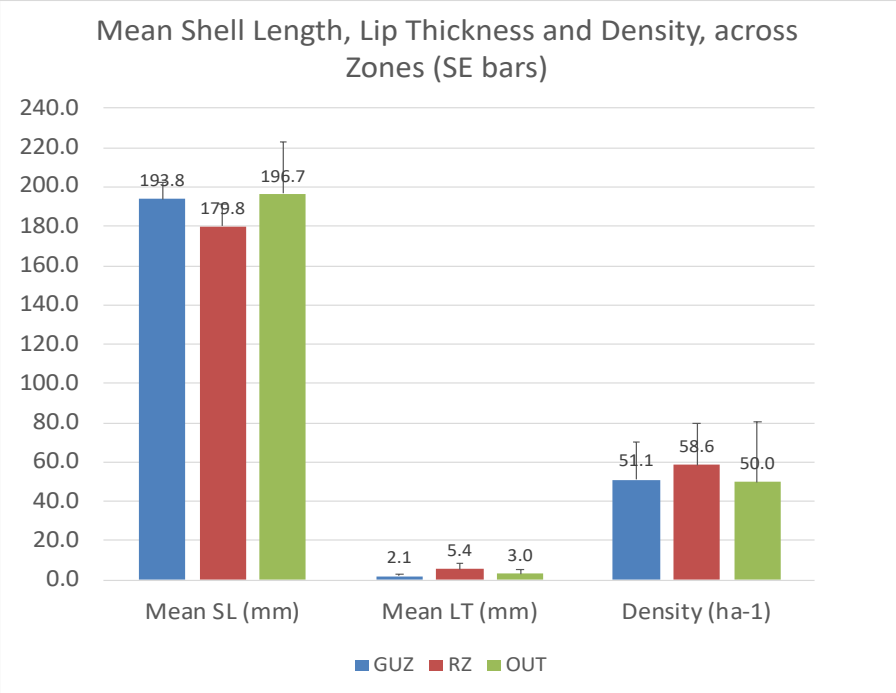

Figure 8 Mean density ha^{-1}, shell length (SL) in mm and lip thickness (LT) in mm of queen conch, among management zones of the PHMR (GUZ-General Use Zone, RZ-Replenishment Zone, OUT-Outside the Reserve) (±Standard Error Bars, S.E.)

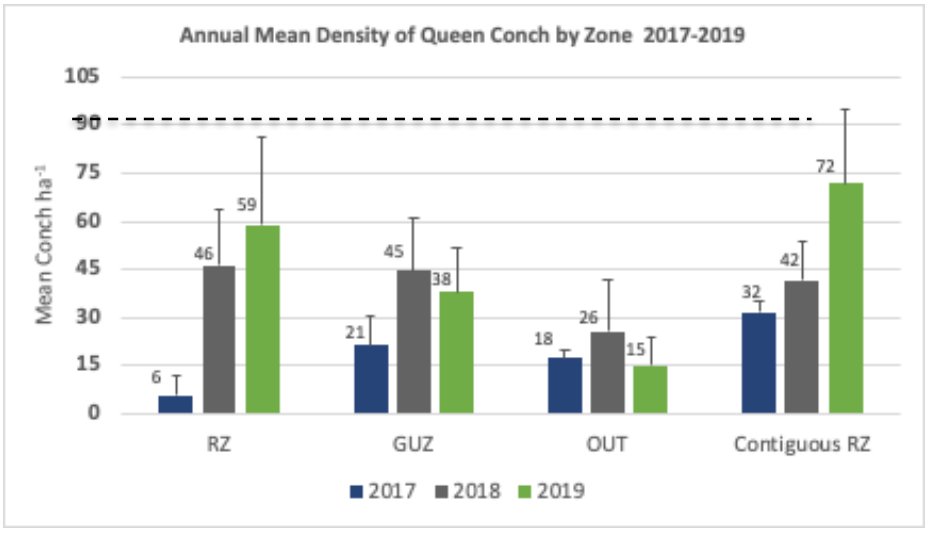

Figure 9 Annual mean queen conch density (ha^{-1}) from 2017-2019 by zone [Replenishment Zones (RZ), General Use Zone (GUZ), Outside the Reserve (OUT), Contiguous RZ] [+Standard Error Bars], Excerpted from Port Honduras Marine Reserve Benthic Commercial Species Update (TIDE 2019)

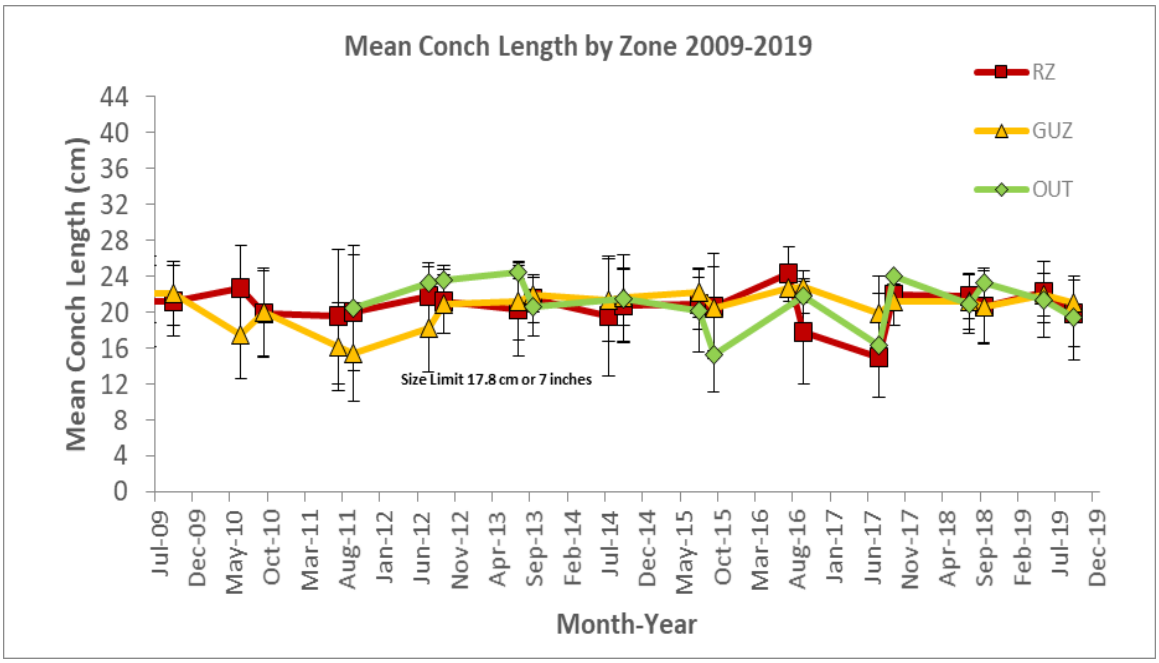

Figure 10 Annual mean conch shell length (cm) by zone for 2019 [Replenishment Zones (RZ), General Use Zone (GUZ), Outside the Reserve (OUT)] [±Standard Deviation], Excerpted from Port Honduras Marine Reserve Benthic Commercial Species Update (TIDE 2019)

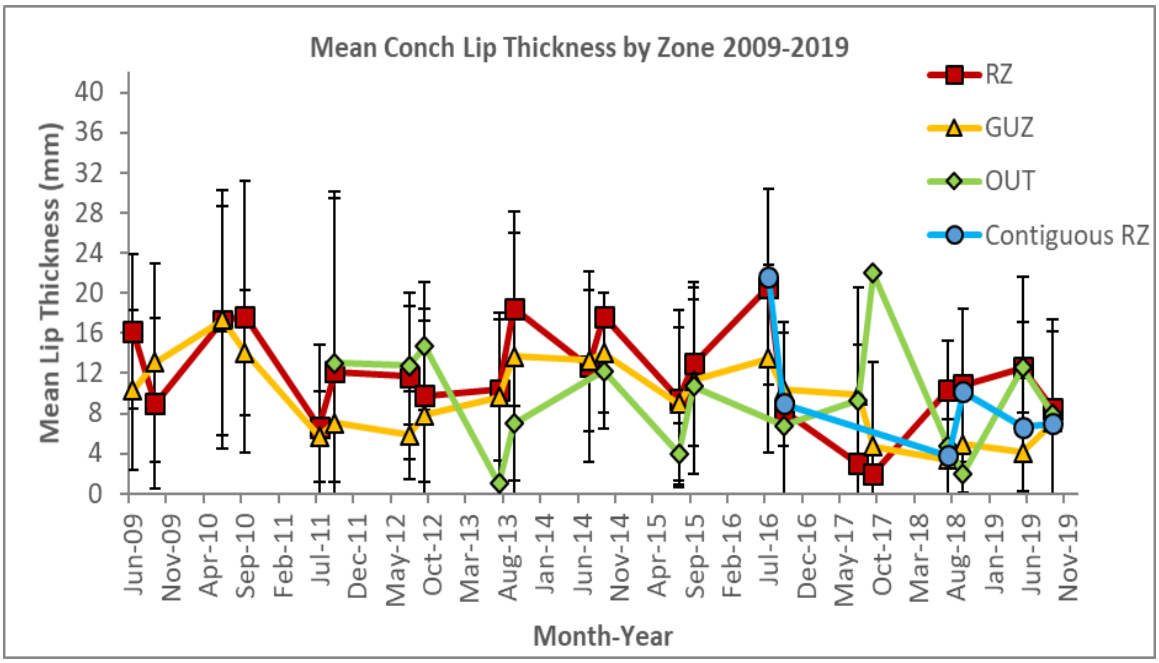

Figure 11 Annual mean conch lip thickness (mm) by zone for 2019 [Replenishment Zones (RZ), General Use Zone (GUZ), Outside the Reserve (OUT)] [±Standard Deviation], *Excerpted from Port Honduras Marine Reserve Benthic Commercial Species Update (TIDE 2019)*

4.0 DISCUSSIONS AND RECOMMENDATIONS

Conch data for 2020 showed an increase in abundance (23-28%) in the replenishment and general use zones and a 230% increase in the sites outside the marine reserve, from 2019. Shell length was similar between the two years. Mean lip thickness showed a downward trend in 2020 and was lower by a factor of 2, which is far less than that suggested for maturity in the literature. Queen conch in the PHMR is present at relatively low densities made up of primarily juveniles, without a flared lip. The density threshold recommended by the Belize Fisheries Department for conch populations is 88 conch ha^{-1} (McDonald 2017), but this is not the density necessary to overcome the "allee effect" since this includes all conch not just adults. The threshold for reproductive success is 50 adult conch ha^{-1} (Stoner *et al.* 2012b, Delgado and Glazer 2020). Since the mean conch density found within the PHMR was 53.5 conch ha^{-1}, the population does not meet the national density threshold nor does it meet the reproductive density threshold.

In terms of maturity, previous studies within PHMR (Foley and Takahashi 2017) showed 50% maturity at 12-15 mm lip thickness, while Tewfik *et al.*, 2019 found 50% maturity within Glover's Reef at >10 mm, and a recent study (Appeldoorn 2020) found maturity at 9 mm. Based on these findings a >10 mm lip thickness is used here to discuss maturity. As such, the queen conch population in the PHMR is made up mainly of immature individuals with only 15% being reproductively mature adults (>10 mm). This translates to very low densities of adults within the reserve, of approximately 8 adult conch ha^{-1}.

The Belize conch regulations has a minimum shell length of 178 mm for legal harvest. Only 55% of the conch surveyed met this legal limit suggesting that only little more than half of the available population is harvestable. However, of this harvestable quantity only 27% was adult conch with lip thickness above 10 mm. Majority were juveniles or sub-adults.

When the management zones were compared for density, shell length and lip thickness, there is a clear function of the replenishment zone having higher abundance of conch and having conch with generally greater lip thickness of legal size, though most conch were immature. This suggests that these zones may be helping with regards to replenishment of conch and acting as a refuge for this commercially important species. Further monitoring over time will provide better confirmation of this. Additionally, these replenishment zones are very small and less than the ideal size required for effective replenishment. Expansion of these replenishment zones are a strategy that should be considered in line with previously identified recommendations,

Overall, the queen conch data for Port Honduras Marine Reserve suggests that the populations are overexploited based on decreasing shell length, low densities and a majority of immature individuals. Given this trend, it is important to maintain regular monitoring of the queen conch population during both the open and closed seasons to assess the effectiveness of both the conch season and the management zones. In 2020, data was collected only once, after the end of the closed season, which provided only a limited view of the population status with respect to fishing influence. A major gap in data for management is data from the queen conch landings within the PHMR. This would provide more details on the mean shell length and lip thickness being harvested and provide an estimate of Catch Per Unit of Effort (CPUE) that would translate to total number of fishers, average catch per fisher and conch production, to compliment data from the conch surveys during and at the end of the season.

It is recommended that annual monitoring for fishery independent surveys (LAMP) be maintained along with the establishment of fisheries dependent monitoring using catch or landings data to include shell length, lip thickness, dirty weight, market clean weight, gender and maturity (external morphology of sexual structures – verge and egg groove (Appeldoorn 1988, Buckland 1989)) to be able to assess the structure of the harvested portion of the population on a long-term basis. This would allow for more accurate trends on how the fishery may be impacting the population, and thereby better inform adaptive management of queen conch fisheries within the PHMR. As has been recommended before, there should be a study conducted to assess deeper waters (10-20 m) to determine whether there is reproductive stock of spawning adults (>20 mm) within in the area. Adult conch have been found to frequent deeper waters, usually on the reef, for spawning activity (Stoner and Schwarte 1994, Stoner 1997, Stoner and Ray-Culp 2000). This would need to be sites with suitable habitat such as sand channels or sandy areas with sparse seagrass and/or algae. The majority of current sites surveyed are within 7 m depth and in the southern barrier lagoon. It would be highly useful to identify and understand the source of conch recruits for the area.

In conclusion, as previous PHMR reports have shown, and other scientific publications within Belize and the region on conch maturity have suggested, the conch regulations should be revised to introduce a management measure for lip thickness that factors in the size relating to 50% maturity. In addition, once data is available on conch landings and catch as outlined above, combined with LAMP data, an annual catch quota for Fishing Area 5 (PHMR) should be developed using population data on abundance, size, biomass and maturity to allow for more sustainable harvests based. Unless these actions are taken, in spite of other existing management regimes, conch populations will continue to decline.

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