



BELIZE FISHERIES PROJECT

Case Study

Queen conch (*Aliger gigas*)

"...harvesting juveniles isn't sustainable or economically sound"

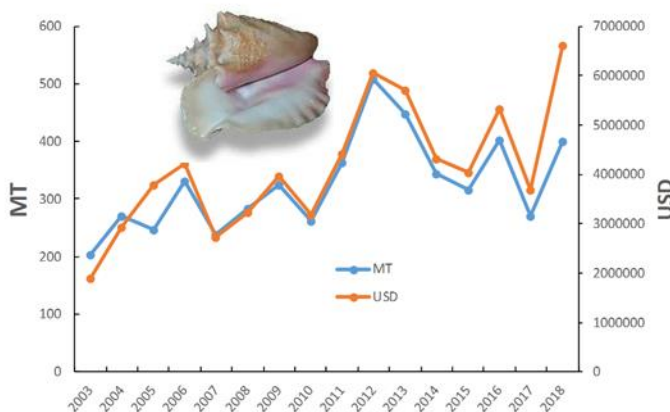
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History, Value & Uniqueness

The large herbivorous snail queen conch (*Aliger/Eubatus/Strombus gigas*) is endemic to the Central Western Atlantic region and has been utilized as food and shell products for thousands of years by indigenous peoples and colonizers [1, 2]. Over the past century, harvests of conch have developed into one of the most important and iconic fisheries within dozens of countries, including Belize, supporting livelihoods in local extraction, processing and export activities [3-5]. Following a temporary closure of the Belize conch fishery in the 1970s owing to overharvesting peaking at 562 MT in 1972, annual catch levels varied between 125 and 275 MT [6]. Recent exports of queen conch meat from Belize have doubled in volume (200 to 400 MT) and more than tripled in value between 2003 and 2018 [7] (Fig. 1) making it the second most important fishery after spiny lobster even as contributions to tourism and household food security is unknown but likely significant.



Appendix II

Figure 1: Export volumes (MT) and value (USD) of queen conch from Belize between 2003 and 2018 (Statistical Institute of Belize, 2019). Note 1 MT (metric tonne) = 2205 lbs.

A large body of research exists on the biology and ecology of the species. However, several unique aspects of conch shell growth (switching from shell length to shell lip with onset of maturity) and complex reproductive ecology requiring minimum adult densities [8-11] has made the application of widely used fish stock assessment techniques difficult. These factors coupled with the relative ease of exploitation across shallow habitats has made the management of queen conch difficult [3-5]. Where field surveys, modified stock assessments, and landings data are available queen conch appear in significant decline and display shifting size- and age-related population structures due to fishing [12-17] even inside protected areas [18, 19] threatening the fisheries and ecological importance of the species. Due to its economic importance and declining populations, queen conch was listed by the IUCN and on Appendix II of CITES as

commercially threatened [20, 21]. The CITES listing requires periodic submission of non-detriment findings to ensure that local extractions do not threaten populations as well as individual permits for all exported products.

Management Problems & Solutions

The conch fishery in Belize is currently managed using minimum size limits (Shell length = SL = 178 mm or market clean meat mass = 85 g) that have not been updated since 1978, a ban on the use of surface supplied air or scuba, a seasonal closure from July through September, and an annual quota generated from data on visual surveys conducted by the Fisheries Department [6, 22]. Unfortunately, the size limits used are both inappropriate and unsustainable given the high numbers of immature individuals that may be legally harvested and goes against fundamental principles of fisheries management [23]. Numerous studies across the range of the species have demonstrated that conch fisheries should be managed on the basis of a minimum shell lip thickness, which is the easiest and most reliable indicator of sexual maturity and thus can prevent harvest of juveniles [3, 11]. Lip thickness minimums can be correlated to meat weights [19, 24] avoiding the need to land shells (Fig. 2).

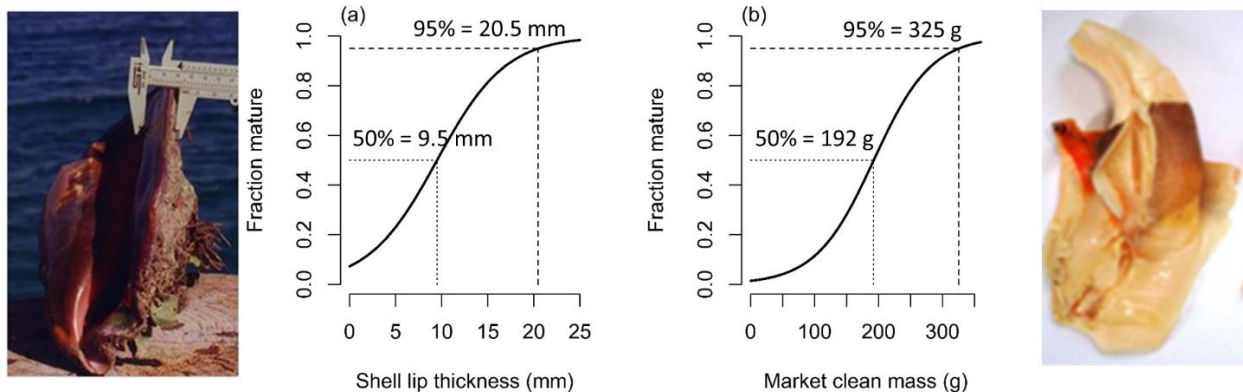


Figure 2: Points of 50% and 95% maturity for (a) shell lip thickness and market meat mass at Glover's Reef marine reserve [19]. Similar results are available for Port Honduras MR [24].

In particular, two independent studies conducted in two different marine reserves (Port Honduras, PH and Glover's Reef, GR) using two different approaches (microscopic gonad tissue analysis and development of external sex organs) both identified mature conch to be those with a thick shell lip regardless of the shell length [19, 24]. Shell lip thickness at 50% maturity, fisheries standard, was determined to range from 12 to 16 mm for males and females respectively at PH [24] and an average of 10 mm for both sexes at GR [19] which is very similar to the 9 mm found in Puerto Rico [25]. Again, given that conchs are a burden to land in the shell the market clean meat weight associated with these shell lip thicknesses were calculated and very similar at 199 and 192 g at PH and GR respectively [19, 24]. In a recent report compiling all known visual surveys specifically for conch (> 46 600 individuals) conducted by NGOs in 7 marine reserves (2004 – 2019), between 21 and 48% of all conch exceeding the existing

minimum legal shell length were immature and up to 27% of all adults were under the minimum legal shell length [26]. In the work from GR, of legal sized (> 178 mm SL) conchs that were harvested by fishers only 27% were mature [19]. In all cases, it is clear that a shell length minimum does not restrict harvest to mature individuals and that some adults may never be harvested as they are too short in shell length. More problematic is the fact that the use of the shell length minimum has caused a biased selection of larger shell length conchs regardless of their age and thus causing a shortening of the SL size distribution of conchs with a flared shell lip (i.e. adults) over the last 15 years [19]. Such a situation has been previously described in fisheries [27, 28]. In the case of conch this causes two negative effects: (1) shorter lipped conch (i.e. smaller shell volume) have reduced reproductive success and (2) shorter lipped conch have diminished economic yield because the soft tissues are smaller [11, 29]. Regarding the minimum adult densities required for successful spawning and recruitment, often cited as 50 mature conch per hectare [10, 30], only a single area open to fishing (Lighthouse) had densities exceeding the 50/ha threshold but many of these conchs were stunted (i.e. samba) adults that would not exceed the current shell length minimum (Table 1). Even within replenishment zones (RZ) where fully protected conch are expected to generate benefits (i.e. recruitment and spillover) to surrounding fished areas the 50 adults/ha minimum was only exceeding in two areas – Gladden spit/Silk Cayes and Laughing Bird Caye (Table 1). Given problems with minimum legal sizes (SL, meat mass) and low adult densities in protected areas it is strongly recommended that a lip thickness (> 10 mm) and associated meat mass (> 192 g) be adopted to manage fisheries size selection and increased protection be given to replenishment zones to maximize benefits of protected conch and other species to fisheries.

Table 1: Summary of queen conch data collected across Belize by a number of NGOs. Thresholds of shell length (175 mm) and lip thickness (10 mm) represent approximate national regulation and estimated size at 50% maturity [19] in Belize respectively.

Site/Protected Area	NGO	Managed Access Area	Time Period of Data Collection	Number of conch examined	Total conch (indiv./ha)		Non-adults	Adult	Adult (>10 mm lip)	
					RZ	GUZ	> 175 mm SL %	<175 mm SL %	RZ	GUZ
Southwater Caye MR	WCS	3	2012-2018	2154	175.1	140.8	47.1	9.0	10.2	10.9
Gladden Spit & Silk Cayes MR	SEA	3	2016-2019	723	253.5	229.9	36.0	2.5	90.3	7.7
Laughing Bird NP	SEA	3	2016-2019	837	280.3	n/a	23.8	5.6	193.1	n/a
Port Honduras MR	TIDE	5	2013-2019	593	24.4	26.6	48.0	3.6	15.1	9.5
Turneffe Atoll MR	UB ERI	6	2013-2019	5129	201.8	116.5	44.9	2.0	5.9	3.6
Turneffe Atoll MR	TAT	6	2013, '14, '16, '17	3609	201.6	140.9	31.3	0.5	7.8	6.9
Lighthouse Reef Atoll (Blue Hole NM, Half Moon Caye NM)	BAS	7	2013-2019	12240	521.0	644.0	21.7	27.1	22.0	375.0
Glovers Reef Marine Reserve	WCS	8	2004-2018	21378	179.0	138.3	10.0	6.4	55.0	15.8
				Mean	231	205	33	7	50	61
				SE	49	71	5	3	23	46
n/a = only data from outside of reserve available										
TIDE: additional 576 conch from Foley (xxxx) maturity study										
BAS: Many samba (mature, but miniature) conch										

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