Status of the Queen Conch on the Windward Islands of the Dutch Caribbean

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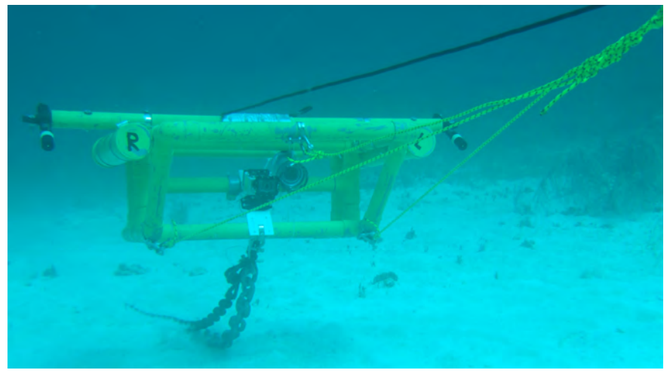
The Queen Conch (*Lobatus gigas*) has been a source of food in the Caribbean for centuries, but recent over-exploitation has resulted in a decrease in population densities across much of the species' range (Acosta, 2006; Stoner et al., 2012b). This large marine gastropod is found throughout the Wider Caribbean Region and the southern Gulf of Mexico, including the islands of the Dutch Caribbean where it is economically and culturally important (Appeldoorn 1994; Brownell & Stevely 1981). Over the past 30 years, harvesting of queen conch has increased considerably in order to satisfy the demand from a growing international market (Theile, 2005) and the Queen Conch is now heavily exploited throughout large parts of its natural range (Acosta, 2002; Stoner, 1997). Queen conch have several biological characteristics, such as the fact that they are slow moving, often occurring at shallow depths, and aggregating during reproductive season, which make them particularly vulnerable to overfishing (Appeldoorn et al., 2011).

Concern for the future of Queen Conch has resulted in a number of regional and international measures, which have been taken to protect them. Trade in Queen Conch came under regulation when the species was listed in Appendix II of CITES in 1992, which prompted *"numerous collaborative initiatives to promote its recovery, reduce overfishing and ensure legal, sustainable trade"* (CITES, 2017). At the first meeting of the International Queen Conch Initiative in 1996, several Caribbean countries adopted the Declaration of San Juan and thereby pledged to improve regional management of the Queen Conch through harmonized regulations, enhanced communication and the application of scientific advice for the management and assessment of stocks (Daves and Fields 2006). In the Dutch Caribbean, a 4-year PhD project entitled "Queen conch in the Dutch Caribbean Territories (CONDUCT)" aims to improve our understanding of the ecology and life history of the Queen Conch and to provide guidelines for a more sustainable conch fishery. The project, which started in June 2014, is part of the TripleP@Sea and is a collaboration between Wageningen University & Research and Wageningen Marine Research.

The accurate estimation of live adult conch densities, in shallow and deep areas alike, is essential to set sustainable harvest quotas and to determine the reproductive success of Queen Conch which are highly dependent on adult conch densities (Appeldoorn et al., 2011). Areas below 20 m have previously rarely been surveyed and areas below 30 m are generally excluded from biomass estimates because of safety limitations and logistical challenges of survey methods using SCUBA (Queen Conch Expert Workshop Group Report 2012, MRAG 2013). Boman et al., (2016) developed a light and affordable towed video method to estimate conch densities throughout the species range to depths of 60 m depth, which has been successfully used for biomass estimates around St. Eustatius, Saba Bank and Anguilla (Boman et al., In preperation).



Towed video array: Towed video array used to survey queen conch throughout the species entire depth range (0-60 m). Photo by: © Boman et al., 2016

Landed queen conch: Landed queen conch from the sustainable fishery in St Eustatius Photo by: © Erik Boman

Unlike many other locations in the Caribbean region, St. Eustatius and the Saba Bank were found to have healthy populations of Queen Conch. The surveys found high densities of adult Queen Conch (>200 adult conch/ha), at depths greater than 25m at both locations. Few areas with high densities of conch were found around Anguilla, which may be explained by the island's higher fishing pressure (Boman et al., In preparation (a)). It should be noted that the Saba Bank was heavily fished prior to the enforcement of fisheries legislation in 1994. In a 4 month period between October 1993 and January 1994, approximately 450000 lbs. (ca. 204500 kg) of conch meat (ca. 900 000 conchs) were caught on the Saba Bank (Sybesma, 1994) indicating a very high fishing effort on the Bank at that time. Although no quantitative biomass estimate data for conch is available for this time period, anecdotal evidence suggests that the Saba Bank was at least partly overfished at this point in time. However, in contrast to other overfished populations in the Caribbean (e.g. Florida) the Queen Conch populations on the Saba Bank seem to have recovered well after the closure of the fishery in 1994.

A key finding from the CONDUCT study is that the majority of Queen Conch regulations currently in place in the Caribbean are not sufficient to ensure that at least half of the population reaches maturity before being harvested (Boman et al., In review). In order to adequately protect conch populations from over-harvesting and ensure the sustainability of the stock, managers must be well informed about the life history of conch in their area so as to protect juveniles and allow mature individuals to spawn at least once before being harvested (Vasilakopoulos et al., 2011). Most nations in the Caribbean region have implemented size regulations for Queen Conch based on outdated and limited biological information. Shell length is commonly used to regulate the fishery (including St. Eustatius, St. Maarten and Curacao) but this is not a reliable indicator of maturity (Stoner et al., 2012a; Foley & Takahashi, 2017). A much more reliable indicator is lip thickness, which develops only after the conch reaches its maximum shell length (Stoner et al., 2012a). The CONDUCT study found that size (lip thickness) of mature conch varied between locations in the Caribbean, from 4 – 14 mm. In most cases females had a larger lip thickness than males at maturity indicating sexual dimorphism (Boman et al., In review).

Knowledge of the reproductive season of Queen Conch is key to the successful implementation of appropriate site-specific regulations to protect them during the spawning season. The reproductive season of Queen Conch differs between locations both in duration and in intensity across the Caribbean region (Avila-Poveda & Baqueiro-Cardenas 2009; Aldana-Aranda et al., 2014). Boman et al. (in prep.) found that locations with a relatively high variation in water temperature had a significantly shorter reproductive season and that most Caribbean nations have a reproductive season concentrated around the warmest period of the year (Boman et al., In review). The implementation of adequate minimum size regulation based on lip thickness (ca. 15 mm) and a Caribbean wide seasonal closure (May - September) using the most up to date biological information (taking into consideration the local differences in lip thickness and reproductive season) will help the long term survival of Queen Conch and the dependent fishery (Boman et al., In review).

The CONDUCT project also studied the impact of invasive seagrass species on juvenile Queen Conch growth. Whilst conch inhabit a range of ecosystems (e.g. seagrass, algae, rubble, sand), juveniles in large parts of the Caribbean are primarily associated with seagrass beds made up predominately of Thalassia testudinum (Stoner, 2006; Stoner, 2003; Alcolado, 1976; Stoner et al., 1996, Stoner 2003). The invasive seagrass *Halophila stipulacea* has spread rapidly throughout the eastern Caribbean during the last decade and has been observed occupying habitats of other native seagrass such as *Thalassia testudinum* (Debrot et al., 2012, personal observation, Boman). There is currently little knowledge of the ecological impact this replacement may cause for species currently living in native seagrasses, including Queen Conch. Changes to biological aspects of juvenile conch can have severe consequences for the resilience of a population and its capability to withstand fishing pressure or other external stressors. The CONDUCT study aims to examine different biological aspects of juvenile conch living in the invasive seagrass *H. stipulacea* and to compare them with conch living in native seagrass. While this part of the study is ongoing, the project was severely affected by Hurricane Irma and Hurricane Maria. However, results obtained prior to the hurricanes indicate that there may be a decrease in growth of juvenile conch in the invasive seagrass compared to the native seagrass. However, definitive conclusions regarding growth in the invasive and native seagrass cannot be made due to the short duration of the experiment (Boman et al.,In preparation (b)).

Queen conch survey: Measuring of lip thickness during queen conch survey (St Eustatius)
Photo by: © Erik Boman

Status of the Queen Conch

A detailed understanding of spatial genetic structure and the factors driving current patterns of gene flow and genetic diversity are fundamental for developing conservation and management plans for marine fisheries (Bay & Palumbi, 2014; D'Aloia, Bogdanowicz, Harrison, & Buston, 2014; D'Aloia et al., 2015; Pinsky & Palumbi, 2014). Connectivity of Queen Conch populations in the Caribbean was studied through a large collaborative effort including researcher from the Wider Caribbean Region. The study investigated the spatial genetic structure and genetic diversity throughout the Queen Conch fishery (19 locations) using microsatellites (Truelove et al., 2017). They found that *L. gigas* does not form a single genetic population in the greater Caribbean and that there are significant levels of genetic differentiation between Caribbean countries, within Caribbean countries, and among sites irrespective of geographic location. Gene flow across the greater Caribbean is constrained by distance, which acts to isolate local populations. This genetic isolation may impede the natural recovery of overfished L. gigas populations, such as in Florida, and results suggest a careful blend of local and international management will be required to ensure long-term sustainability for the species (Truelove et al., 2017).

Challenges facing Queen Conch include continued high demand for conch products from the international market, and loss of suitable habitat-through eutrophication, acidification, sedimentation, and runoff from land (Appeldoorn et al., 2013). There are also emerging threats, such as the introduction and rapid spread of the invasive seagrass *H. stipulacea* throughout the Caribbean as well as the implications of climate change, the impacts of which cannot be predicted. Although the situation for Queen Conch populations in some part of the Caribbean region is uncertain (Acosta, 2006; Stoner et al., 2012b), healthy and viable conch populations and sustainable conch fisheries can still be found in the Dutch Caribbean (Boman et al., In preparation (a)). New studies, such as the ones described above and others, have and will continue to increase the knowledge of the conch biology and ecology as well as providing first insights into potential future threats. Local and international collaborative efforts such as the establishing of the Queen conch expert workgroup has led to a set of recommendations on many aspects of the Queen Conch fishery (Queen Conch Expert Workshop Group Report, 2012), which if implemented would undoubtedly be a big step forward on the path to a more sustainable conch fishery. However, to preserve this iconic species for future generations public and political support is necessary to implement the changes needed to improve management.

Queen conch (*Lobatus gigas*): Eye of adult queen conch
Photo by: © Mike Harterink

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