Surveying Deep-water Conch (*Lobatus gigas*) Populations Using a Towed Video System

Encuesta sobre las Poblaciones de Lambi (*Lobatus gigas*) Aguas Profundas Utilizando un Sistema de Video Remolcado

Les Populations de Lambi (*Lobatus gigas*) des Eaux Profondes à l'Aide d'un Système Vidéo Remorqué d'Arpentage

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EXTENDED ABSTRACT

Introduction

The marine gastropod Queen conch (*Lobatus gigas*) is one of the most economically important and heavily exploited species in the Caribbean region (Brownell and Stevely 1981). Queen conch stocks have been heavily fished in many areas, predominantly in relatively shallow depths (< 15 m) easily accessible to free diving fishermen (Tewfik 2002). As conch densities in the shallow areas decrease, fishers must venture deeper to find conch. Other authors suggest that these deep water populations are a primary source of larvae for the shallow water populations (Stoner et al. 1992). As fishers are now targeting these deep populations it is important to accurately, safely, and economically make stock estimations. In order to properly manage conch fisheries, accurate estimates for shallow as well as deep water populations are need. Conventional dive surveys are currently the most common method used to survey conch populations. This method has limitations; as depth increases bottom time is restricted, and the dangers associated with increased depth also make deep dives more dangerous. Using technical divers to survey deep water conch populations, which can be found to a depth of 60 m (Randall 1964), is not cost-effective and the technical expertise is beyond most Caribbean nation's capacity. Therefore, we have developed a safe and efficient towed video system which is able to survey deep water conch populations. The system has been used in the waters of St Eustatius, located in the northeastern Caribbean, to determine if the local conch population could support a small-scale commercial fishery. The adult Queen conch population was assessed using a towed video system in combination with scuba diving. To validate the video system and compare it to diving, a series of calibration transect covered by both a diver and the towed video array was conducted.

Material and Methods

Fieldwork was conducted between August 2013 and September 2014 in the St Eustatius National Marine Park, which extends from the high water mark to a depth of 30 m and covers an area of 2,700 ha. Dive surveys for abundance estimates were conducted using two divers. On each location the divers covered two or three transects, 50x10m each, depending on depth and bottom time available. In deeper water a towed video system was used to survey the adult conch population. The towed video system was based on the design of Stevens (2006) and Sheenan et al. (2010), developed by van Rijn (2013). The video array is towed behind a boat at low speeds just above the sea floor. A camera (GoPro 2, 1080p 30fps) attached to the array recorded the substrate along a 500x1m transect. Two lasers attached to the array 1m apart indicated the width of the transect. Depth and length of each transect was recorded by GPS and all conch within the transect were recorded for density and abundance estimates. The numbers of live adult conch (with a flared lip) were calculated per hectare. Habitats were divided into five main habitat categories: sand, rubble, algae and seagrass for both methods, and reef for dive surveys only. Depth was classified in two categories for the dive surveys, 1 - 16 m and 17 - 31 m, and three for the towed video surveys 1 - 16 m, 17 - 31 m, and > 31 m. Density data for dive and towed video surveys were combined and stratified by habitat for total abundance estimate.

To determine the towed video system's ability to accurately identify adult (flared lip) conch in comparison to the dive surveys, a calibration of the method was conducted. Two divers were towed with the array and recorded all adult conch, (dead and live) within the 1 m transect indicated by the lasers. Simultaneously, the camera on the array recorded the same transect and the counts of the diver and the video analyses was compared for each transect separately. The analysis of the videos was performed by an person with no knowledge of the divers counts. Two habitats were sampled, rubble/algae and sand/seagrass. Rubble/algae being the most difficult habitat to video analyze and sand/seagrass being the easiest, the samples from the two habitats were analyzed separately for the method comparison analysis.

Results

The abundance survey conducted showed and overall mean abundance of 57 adults/ha for the dive data and 115 adults/ ha for the video data. Highest abundance of adult conch was found west of the island (Figure 1), densities with more than 500 adults/hectare were found on several occasions. The highest density recorded was 950 adult conch/ha during a dive transect. A total of 62 locations were surveyed using diving, covering a total area of 7.5 ha and a total number of 65 locations were surveyed using the towed video system, covering an total area of 3.5 ha. Highest densities of conch were

found in the rubble, having a significant effect on density compared to the other habitats for both methods. Although there seemed to be a tendency for a higher abundance of conch in deeper waters the effect was not significant. For the calibration of the towed video method a total of 26 calibration transects covered an area of 1.6 ha. No significant difference was found between the two methods (towed video and diving) in finding adult (flared lip) conch in either habitat. A total amount of 75 adult conch were found by the divers in the sand/seagrass transects, whereas 73 adult conchs were found during the video analysis and a total amount of 575 adult conch were found by the divers in the rubble/algae transect, whereas 541 adult conch were found during the video analysis. There was a general underestimation of adult conch in the video analysis compared to that of the dive counts of 2.7% and 5.9 % in sand/seagrass and rubble/algae, respectively.

Discussion and Conclusion

The densities of adult Queen conch recorded in the waters around St Eustatius (0 - 31 m) are in comparison to other studies moderate to very high (Chalifour 2009, Stoner et al. 2009). More adult conchs were found in the towed video survey than in the dive survey, this due to the difference in habitats sampled by the two methods. As the video method has habitat limitations, such as not being able to navigate over high obstacles, reef habitats where conch are not commonly found in high abundance (Randal 1964) were sampled exclusively by diving. This lowered the overall conch found in the dive transect compared with the towed video transect. The total queen conch stock mean is estimated to be 186,000 adult queen conch (C.L.: 110,000-270,000) in 2,700 ha. The number indicates a possibility for a small scale fishery. However, harvest restrictions are advised for a sustainable conch fishery not exceeding the recommendation of the Queen conch working group MSY of 8% of the adult stock. When comparing the two methods on similar habitats, densities were similar, indicating a justification for combining the results from both methods. The calibration also confirms this, as no significant difference in the ability to find adult conch could be found between the two methods, on either of the two habitats sampled i.e. rubble and sand. There were for both habitats a general underestimation of 5.2% adult conchs recorded by the towed video compared to the divers counts, thus there may be a small underestimation by the towed video. Based on the result of the abundance study and the towed video calibration we conclude that the methods are comparable and can be used interchangeably to assess adult conch stocks. The results from the video calibration did however show a significant difference in the ability to find sub-adult, juvenile and dead conch of any size. The towed

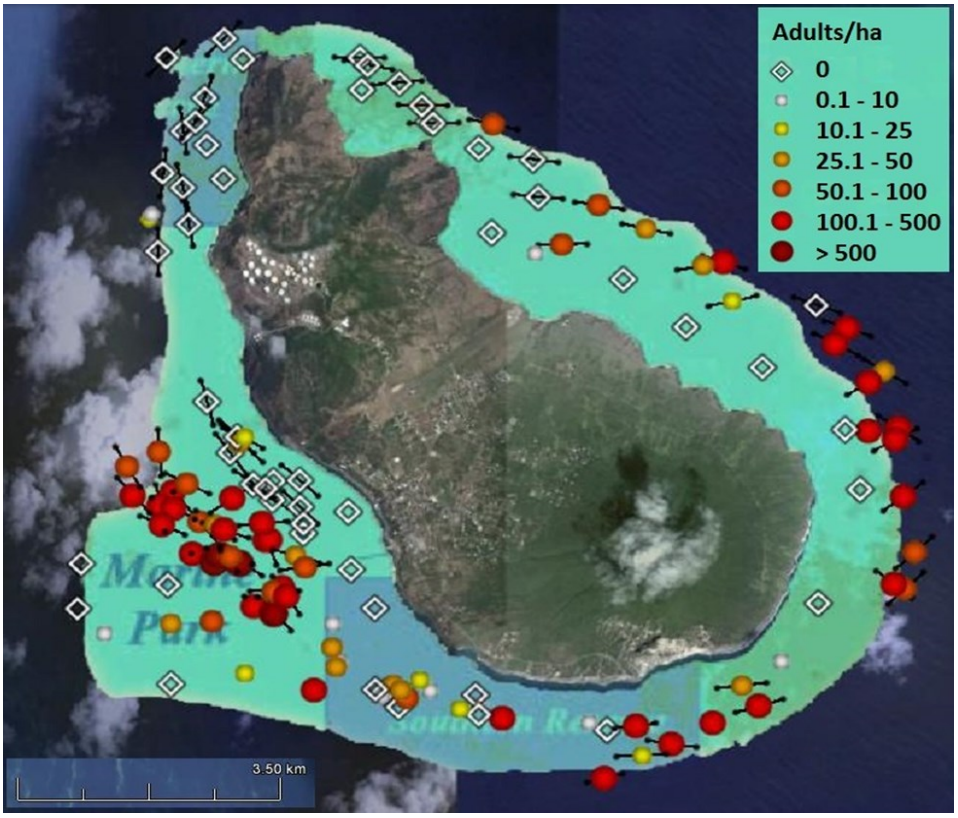

Figure 1. Adult queen conch density per hectare for the towed video survey (symbols with line through) and dive survey (symbols without line) around St Eustatius. The black lines represent the transect length and direction of the towed video surveys. The Statia National Marine Park and 30 m depth contour is shown in green and blue (marine reserves).

video setup which was used in this study is not suitable to assess densities of any other size class than adult conch (flared lip). With rapid technical advancements it is possible that sub-adult and juvenile densities can be accurately assessed with this method in the future. The towed video method should be used as a complement to dive surveys, especially although not exclusively when assessing deep water conch populations. A combination of the two methods will always be recommended as lip thickness and other biometric parameters are not possible to record with the video method.

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