

First Implementation of Queen Conch Stocks Monitoring in Guadeloupe on Six Marine Sites in its Archipelago

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ABSTRACT

Queen conch (*Strombus gigas*) is an intensively exploited species all over the Caribbean and particularly in Guadeloupean archipelago. Considering the economical importance of this fishery and threats on the regional stock, Regional Fisheries Committee is initiating on European and French national subsidy, a monitoring of Guadeloupean Queen conch stocks variation. A simple methodology allowing the evaluation of Queen conch's densities using an underwater towed camera was developed in order to be freed from logistical and financial diving's constraints. In 2009, this study allowed a first estimation of stock density in 6 stations (4 to 10 transects per station) of the Guadeloupean fisheries. This protocol offers the advantage of sampling large surfaces in few times and for a moderate cost. The experimental average density was estimated about 26.89 conch.ha⁻¹, with a minimum of 4.1 conch/ha and a maximum of 59.48 conch/ha, for a total sampled surface of 7.07 ha. The study reveals that a minimum surface of 1 500m² is requested to observe a stabilization of the estimated conch densities, whose distribution is very dynamic and heterogeneous. In Marie Galante, the highest densities observed between 5 to 10 meters of depth in 2008, were confirmed in 2009. This reliable and easily implemented method is now used to monitor the exploitable stock of Queen conch and white sea urchin (*Tripneustes ventricosus*) in Guadeloupe. This process is by now applied to monitor a bay in Marie Galante, which will be the site of a fishing reserve project.

KEY WORDS: *Strombus gigas*, stock assessment, Guadeloupe

Primera Estimación de los Recursos de Caracol Rosa (*Strombus gigas*) en Seis Estaciones de Guadalupe, en 2009

El Caracol rosa (*Strombus gigas*) es una especie intensamente explotada en todo el Caribe, y particularmente en el archipiélago de Guadeloupe. Considerando, la importancia patrimonial y económica de este recurso, el CRPMEM de Guadeloupe inicia, con fondos europeo y nacionales franceses, un estudio para estimar las variaciones de poblaciones de la especie en el archipiélago. Proponemos una metodología que permite estimar las densidades de Caracol rosa con una cámara submarina remolcada, con el fin de librarse de coacciones logísticas y financieras de muestreos en buceo. En 2009, este programa permitió la realización de una estimación de densidades de Caracol rosa en 6 estaciones (4 - 10 transectos por estación). Este protocolo ofrece la ventaja de cubrir grandes superficies en poco tiempo y a menor costo. La densidad media observada es 26.89 ind.ha⁻¹, con un mínimo de 4.1 ind.ha⁻¹ y un máximo de 59.48 ind.ha⁻¹, para un total de 7.07 ha muestreados. Los resultados indican la necesidad de cubrir una superficie mínima de 1 500m² para conseguir una estabilización de la densidad observada, considerando la heterogeneidad de distribución de las poblaciones. En el sitio de Marie Galante, el pico de densidades entre -5 y -10 m observado en 2008, se confirma en 2009. Este método, simple y fiable se aplica actualmente en Guadeloupe para el monitoreo los recursos de *Strombus gigas* y del erizo comestible (*Tripneustes ventricosus*). En las zonas costeras la isla de Marie Galante, el método esta empleado para el monitoreo de los recursos en una área protegida dedicada al manejo pesquero de estas dos especies.

PALABRAS CLAVES: *Strombus gigas*, estimación de poblaciones, Guadalupe

Première Évaluation des Ressources en Lambi (*Strombus gigas*) sur 6 Stations de Référence de Guadeloupe, en 2009

Le lambi (*Strombus gigas*) est une espèce intensément exploitée dans toute la Caraïbe et notamment dans l'archipel guadeloupéen. Face à ce constat et aux vues de l'importance du marché que génère cette ressource, le CRPMEM Guadeloupe initie grâce à des fonds européen et nationaux, une étude visant à estimer les variations de stock de cette espèce dans l'archipel. Pour répondre à cette problématique, nous proposons une méthodologie permettant d'évaluer les densités de lambi à l'aide d'une caméra sous-marine tractée, dans le but de s'affranchir des contraintes logistiques et financières de la plongée en scaphandre autonome. En 2009, ce programme a permis la réalisation d'une première estimation des densités de lambis sur 6 stations (4 à 10 transects par station) des pêcheries guadeloupéennes. Ce protocole offre l'avantage d'échantillonner de grandes surfaces en peu de temps et à moindre coût. La densité moyenne mesurée est de 26,89 ind.ha⁻¹ avec un minimum de 4,1 ind.ha⁻¹ et un maximum de 59,48 ind.ha⁻¹ pour l'ensemble des stations, soit 7,07 ha échantillonnés. Les résultats produits révèlent la nécessité d'échantillonner au moins 1 500m² pour observer une stabilisation de la densité estimée, compte tenu du caractère hétérogène et fluctuant de la répartition de la population cible. Pour la station de Marie Galante, le pic de présence d'individus entre 5 et 10 mètres déjà observé en 2008, a pu à nouveau être caractérisé en 2009. Cette méthode simple et fiable est actuellement appliquée au suivi des stocks de lambis et d'oursins blancs (*Tripneustes ventricosus*) dans l'archipel. Dans le cas de Marie Galante, cette dernière permet le suivi d'une zone où sera mis en place un projet pilote régional de cantonnement de pêche.

MOTS CLÉS: Pêcherie, *Strombus gigas*, lambi

INTRODUCTION:

The marine invertebrate *Strombus gigas* (Linnaeus, 1758) has a long history of supporting subsistence and commercial Caribbean's fisheries, as it is relatively easy to catch and highly nutritious (Doran 1958, Mulliken 1996, Sadler 1997). Recently, the increase in economic demand due to the increase in population and in tourism's activities encouraged the development of commercial fisheries. Today, *S. gigas* is supposed to be the second most exploited resource after the spiny lobster in the Caribbean (Aiken et al. 1999, Aiken et al. 2006, Theile 2001). Thus, a variety of measures has been taken in many areas to prevent over-fishing of Queen conch stocks (Appeldoorn 1994).

In Guadeloupe part of the French West Indies, the practice of Queen conch fishing is regulated by the prefectural by-law of 2002, which limits conch fishing to professional fishers. This activity is authorized from the 1st of October to the 31th of December, from a depth of 0 to 25 meters. It is extended to the 31th of January beyond a depth of 25 meters. Each captured conch must present a well-flared shell lip and a minimum fresh meat weight of 250 g.

As the Queen conch is a valuable resource, illegal captures are very common in the areas dedicated to Guadeloupian fisheries. Until 2007 there was no monitoring program surveying *Strombus gigas* landings or the densities of the local population. The only existing monitoring program is the one conducted by the National Park of Guadeloupe in the Protected Marine Area of the "Grand Cul-de-Sac Marin", a program that began in 2005 (Mége and Delloue 2007). But this survey is carried out on transects of 600 m² of seagrass beds by professional scuba divers in accordance with the French labor code. *Strombus gigas* is known to be widely spread on various types of substrate and within depths ranging from 0 to 100 meters, so stock-monitoring programs must consider conch heterogeneous spread on wide areas.

The scope of this paper is to present the first implementation of a simple methodology developed by the CRPMEM Guadeloupe, allowing the evaluation of Queen conch densities with as few logistical and financial constraints as possible (Chalifour and Scolan 2008). Our purpose is to estimate Queen conch densities and their fluctuations to provide a better management of our regional *Strombus gigas* stocks.

MATERIAL AND METHODS:

The Queen conch has been widely exploited over years in the Guadeloupian archipelago. The first step of our project was to identify the actual localization of the fisheries, and the fishing gear that they used. Thus 7 reference sites were identified and recorded in a Geographical Information System project under the "GV SIG 1.1" freeware (Chalifour and Scolan 2008). Six of the 7 sites are actual conch fishing areas and 1 is located in the PMA of the "Grand Cul-de-Sac Marin" (Figure 1).

In each site, randomized transects were conducted with an underwater towed digital camera. We used a PANASONIC 1/3" CCD camera, providing a resolution of 752 x 582 pixels (Figure 2). A special casing was designed for the protection of the equipment and for its stabilization.

On each site, 2 randomized transects are realized for each depth scale of 5 meters between 0 to 25 meters (0-5; 5-10; 10-15; 15-20; 20-25 meters), when the seabed profile allows it. Transect positions are recorded with a GPS. Two parallel laser pointers are placed on each side of the camera creating a reference point for the determination of the span of the field of analysis. Digital movies were then simultaneously recorded and viewed on a portable media player Arcos 7, with a 7" screen and an internal hard-drive.

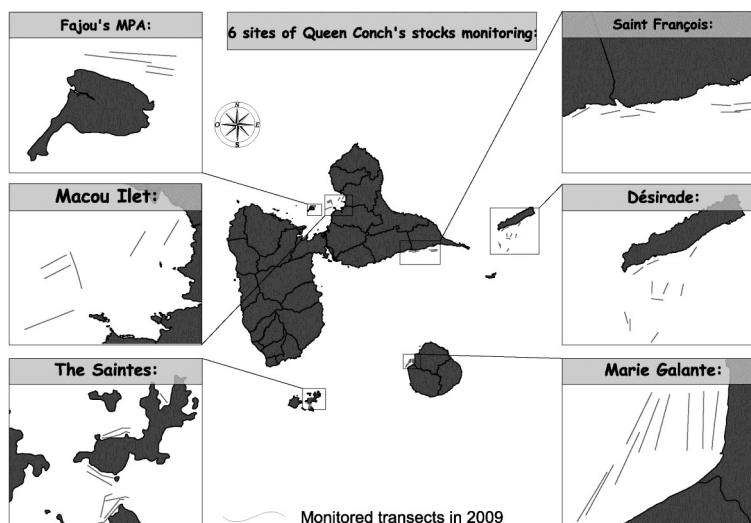


Figure 1. Map of Guadeloupe and the 6 sampling sites surveyed by the CRPMEM Guadeloupe in 2009.

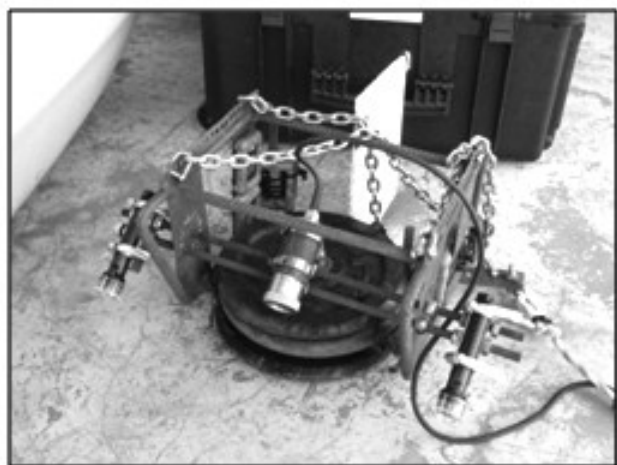


Figure 2. Picture of the casing designed to protect and stabilize the equipment during towed transects.

In March 2009, the survey was done at Marie Galante, Saint-François, Macou, the Saintes and in the MPA of Fajou. But we weren't able to organize the survey of Basse-Terre on time.

Recorded videos are analyzed by 2 operators via the BSPlayer 1.37 freeware. The area of each filmed transect is determined. Conches are counted and conch densities by depth are calculated for each site. The recorded data will be compared with future monitoring programs in order to assess stock variation in the Guadeloupian conch fisheries. This data could also provide information about conch density by type of substrate (Chalifour and Scolan 2008).

Future data will be statistically tested in order to estimate inter-annual stock variations in the conch fisheries of Guadeloupe, providing information for stock management and regulation adjustment.

RESULTS

During our first field test in 2008, we encountered 179 Queen conches and surveyed over 47 700 m² (4.77 ha) through 29 transects ranging from 196 to 2069 meters long and between 0 and 15 meters deep. In 2009, 190 Queen conches were observed over 46 transects and 7,066 ha investigated, during the first implementation of the monitoring program. *Strombus gigas* densities, sites and monitored areas are given in Table 1.

The density observed on each transect range from 0 conch per hectare to 178.5 conch per hectare. Mean density by site is ranging from 4.101 conch/ha at Désirade to 59.478 conch/ha at Marie Galante. The global mean density was about 37.52 Queen conch per hectare of monitored seabed. The mean recorded density was about 26.89 conch/ha in March 2009. The survey only took 10 days of fieldwork, for 46 monitored transects.

DISCUSSION AND CONCLUSION

The camera prototype designed by the CRPMEM staff has completed its role. The film transects allowed an estimation of Queen conch stocks in six sites. This survey constitutes the first step in future Guadeloupian Queen conch stock assessments. This protocol took very short time for a lot of recorded data.

One of the main benefits of this method is that it is easily applied with little human resource. Only 3 people are needed to realize transects: 1 pilot, 1 camera-positioning operator and 1 image-recording and GPS-plotting operator whereas scuba-diving transects require at least 4 professional divers (according to the French working regulations).

A known decline of reproduction could occur when conch density falls below 50 conchs per hectare on reproductive aggregations. As a consequence the Queen conch stock seems to be over exploited in Guadeloupe, but

Table 1. Recorded results of the CRPMEM's monitoring program in 2009.

Site	Date	Depth	N.b of <i>S. gigas</i>	Area (m ²)	<i>S. gigas</i> /Ha/ depth	<i>S. gigas</i> /Ha/site
Fajou	22/04/2009	0-5m	19	3811.00	49.86	49.86
Macou	21/04/2009	0-5m	21	6038.90	34.77	39.60
Macou	21/04/2009	5-10m	26	5829.21	44.60	
Saint François	16/03/2009	0-5m	0	1329.32	0.00	
Saint François	16/03/2009	5-10m	5	3247.45	15.40	
Saint François	16/03/2009	10-15m	1	5189.28	1.93	6.32
Saint François	16/03/2009	15-20m	3	4478.23	6.70	
Désirade	19/03/2009	5-10m	1	5433.17	1.84	
Désirade	19/03/2009	10-15m	4	5543.40	7.22	4.10
Désirade	19/03/2009	15-20m	1	3653.51	2.74	
Marie-Galante	17/03/2009	0-5m	19	3220.06	59.01	
Marie-Galante	17/03/2009	5-10m	42	2664.53	157.63	59.48
Marie-Galante	21/03/2009	10-15m	18	3476.28	51.78	
Marie-Galante	21/03/2009	15-20m	2	4257.52	4.70	
Saintes	22/03/2009	0-5m	7	2038.08	34.35	
Saintes	22/03/2009	5-10m	6	4958.26	12.10	
Saintes	22/03/2009	10-15m	13	2917.98	44.55	22.42
Saintes	22/03/2009	15-20m	2	2576.99	7.76	

the survey was performed just after the legal fishing season and not during the conch aggregating season. Unfortunately, Queen conch populations monitored at Désirade and Saint-François really seemed to be depleted.

No significant difference was noticed between recorded densities from 2008 and 2009, at Marie Galante and Macou. A significant difference was observed between sites densities in 2009. Conch density at Désirade seemed to be significantly different from those observed at Macou, Marie Galante and in Fajou MPA.

Results provided by our protocol are very similar to those found in other Caribbean fisheries. The final step would be to validate this protocol with transects realized both with the towed camera and with scuba divers, allowing the estimation of the difference between filmed conch density and conch density observed by divers.

A greater presence of Queen conch was also noticed between 5 and 10 meters depth on sites monitored in both 2008 and 2009 (with 22% of mature conches).

Another benefit of this method is that the data collected and stored could be used for various monitoring programs: seagrass beds monitoring, habitat quality estimate, macro fauna monitoring, lost and ghost fish-traps retrieval. Accordingly, video transect must be recorded with data comprising the date, the position, and the filming conditions. These precautions will allow anyone to reuse these data for any other management program.

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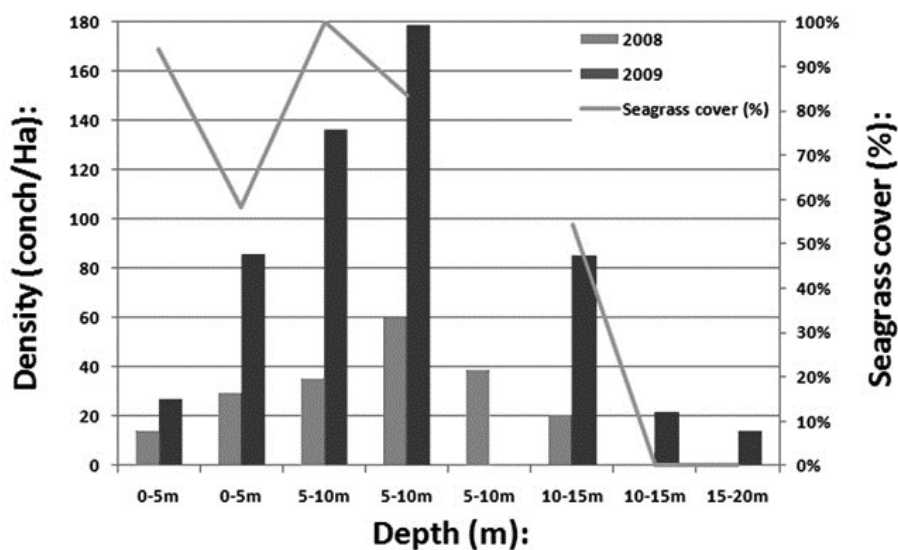


Figure 3. Conch mean density (conch/ha) at each monitored depth during the last 2 years