

Preliminary Observation of Natural Feed of Queen Conch *Strombus gigas*

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ABSTRACT

The queen conch *Strombus gigas* is a marine resource of ecological and economical importance in all the Caribbean countries. A severe depletion of most populations due to over-fishing is forcing the establishment of regulatory measures and closure of fishing areas in most Caribbean countries. Aquaculture programs are developing in the USA, Turk and Caicos, as well as Mexico and some other countries. However, one of the bottlenecks for queen conch culture is the lack of well adapted formulated food for optimal growth in high density rearing. Nutrient requirements for conch juveniles are slightly well-known (Davis 2000 and Aldana Aranda, *et al.* 2007). To assess the natural diet of queen conch the examination of stomach contents was made from individuals fed with natural foods in the field. The stomachs of conchs fed with natural foods were studied by analyzing stomach content by optical microscopic with taxonomic references of Joly (1967), Jahn, *et al.* (1979), Brusca and Brusca (1999) and Graham and Wilcox (2000). The total number of items in stomach contents was 22, which 15 were in adult and 12 in juveniles. The most diverse Phylum was Rhodophyta with 5 categories. The second largest groups were Cyanophyta and Protozoa with three categories in each one. A seagrass had an important biomass in one of the adults. These data to help to adjust better the feed formulation and the frequency of feeding to the real need of organism according to their age and size.

KEY WORDS: Queen conch, natural, food, stomach

Alimentación Natural del Caracol Rosa, *Strombus gigas*

El caracol rosa *Strombus gigas* es el recurso pesquero de mayor importancia pesquera y ecológica en el Caribe. La caída drástica de los volúmenes de captura debido a la sobre pesca ha causado la instauración de medidas de regulación pesquera y el cierre de áreas de pesca en la mayor parte de los países del Caribe. Los programas de acuicultura se han desarrollado en Estados Unidos, Turk and Caicos, México y otros países. Sin embargo uno de los cuellos de botella para su cultivo es la falta de alimentos adecuadamente formulados para su óptimo crecimiento en densidades altas de cultivo. Los requerimientos nutricionales de esta especie en su fase juvenil son poco conocidos (Davis 2000 and Moreno and Aldana Aranda 2007). A fin de establecer la dieta natural del caracol rosa se examinaron contenidos estomacales de animales colectados en el medio natural, alimentados con una dieta natural. Los contenidos estomacales fueron analizados con microscopio óptico utilizando las claves taxonómicas de Joly (1967), Jahn, *et al.* (1979), Brusca y Brusca (1999) y Graham and Wilcox (2000). El total de especies encontradas en los contenidos estomacales fue de 22, de los cuales 15 estuvieron presentes en los adultos y 12 en los juveniles. El Phylum más diverso fue el de las Rhodophytas con 5 categorías. El segundo grupo fue el de las Cianofitas y Protozoarios con tres categorías cada una de ellas. Los pastos marinos representan una fuente importante de biomasa en los adultos. Los resultados de este trabajo ayudaran a ajustar la formulación de las dietas y la frecuencia de alimentación a las necesidades reales de alimentación de esta especie ajustándola a su edad y talla.

PALABRAS CLAVES: Caracol rosa, alimentación, natural, estomacal, análisis

Alimentation Naturel du Lambi *Strombus gigas*

Le lambi *Strombus gigas* est une ressource marine de grande importance écologique et économique dans tous les pays de la Caraïbe. Une importante réduction de la plupart des populations a rendu nécessaire l'instauration de réglementations des pêches et la fermeture de zones de pêche dans la plupart des pays de la Caraïbe. Des programmes d'aquaculture se sont développés aux USA, à Turks et Caïcos ainsi qu'au Mexique et dans quelques autres pays. Cependant un des goulots d'étranglement pour l'élevage du lambi est le manque d'aliment synthétique bien adapté pour une croissance optimale dans les conditions d'élevage intensif.

MOTS CLÉS: Lambi, naturel, nutrition, contenu

INTRODUCTION

The queen conch *Strombus gigas* is a marine resource of ecological and economical importance in all the Caribbean countries. The queen conch, *Strombus gigas* represents one of the most valuable demersal resources in the region, exceeded only by the spiny lobster. Nowadays, conch meat is no longer an inexpensive food as it was some years ago. Conch meat prices at local markets vary from 10 to 15 US \$/kg until 25 Euros / kg in the French

West Indies, for locally fresh meat. Queen conch is one of the largest herbivorous gastropod mollusks, which uses a highly extendable proboscis to graze macro algae and rake sea grass blades. Its possession of a large crystalline style has been considered as a microphagous gastropod. However, it may feed as well on macroalgae as on biofilm. Its digestive gland presents original features, probably related with its various functions and with feeding habits of queen conch. Conchs are usually associated with sea grass beds adjacent to the shallow, coarse grained sand bars that

they previously inhabited. Due to overexploitation of *S. gigas* stocks, aquaculture programs are developing in the Caribbean. However, one of the bottlenecks for queen conch culture is the lack of well adapted formulated food for optimal growth in high density rearing. Nutrient requirements for conch are slightly well-known. (Davis *et al.* 2000 and Moreno and Aldana Aranda 2007. The goals of this study were to assess the natural diet of queen conch the examination of stomach contents was made from individuals fed with natural foods in the field.

MATERIEL AND METHODS

Conchs were sampled at San Pedro, Belize 18° 22' N and 87° 16' W. Conchs sampled were adult (with a shell length of 22 cm and a shell lip over 10 mm thick) and juvenile that un length shell under 15 cm. Stomachs were processed through standard techniques and their contain were meshed at 700 µm, dried in absorbent paper and weighted at 0.002g with a Ohaus Explorer balance ($\pm$ 0.002g). The stomachs of conchs fed with natural foods were analyzing by optical microscopic with taxonomic references of Joly (1967), Jahn *et al.* (1979), Brusca and Brusca (1999) and Graham and Wilcox (2000). Stomach contain was classified in filamentous algae, parenquymal algae, sea grass, mollusks, crustaceans, bryozoarios, chitin fragments, calcified fragments, unidentified material, sand, and fragments less than 700µm. Each category was weighted. The systematic list was drawn up according to Graham and Wilcox (2000) for cyanophytes algae. Wynne (1986) classification was used for green, brown and red algae and its classification (<http://www.itis.gov>) for protozoa.

RESULTS

The total number of items in stomach contents was 22, of which 15 were taken from adults and 12 from juveniles (Table 1). The most diverse Phylum was Rhodophyta with five categories. Clase Florideophyceae, Orden Rhodymeniales Familia Champiaceae *Champia* sp. Orden Ceramiales, Familia Rhodomelaceae, *Laurencia* sp., and two others species which are not identified. The second largest groups were Cyanophyta and Protozoa with three categories each one: Two of Chroococcales Orden with Gleocapsal sp Chroococcal sp founded in juveniles stomachs and Orden Nostocales with a filamentous Cyanophyte without heterocistos. A sea grass of Phylum Magnoliophyta had an important biomass in one of the adults and juveniles. Table 1 summarizes elements of contain stomachs of adults and juveniles of conchs, *Strombus gigas*. Table 2 summarizes biomass (g) for each group identified in stomachs of *Strombus gigas*. The weight of stomach contents was 1.48 - 2.95 and 0.07 g for adults and juveniles conchs, respectively. Biomass of sea grass was the most important in the stomachs, then sand and fragments less than 700 µm. Filamentous algae are those in smaller presence in the stomachs. In juveniles

conchs only some mollusks, chitin fragments and calcified fragment > 700 µm could be weighed.

Figure 1 shows zoobenthos founded in the stomach contents of queen conchs. 1, Bryozoario; 2, Ostracoda; 3, Protozoario euglenoide; 4, Protozoario flagelado; 5, Protozoa; 6, Radiolario and 7, Foraminifero. Figure 2 illustrated plants established in stomachs contain of conchs. 1. Cyanophyte (Gleocapsal); 2. Rodofita (Rhodomel); 3. Cianofita (Chroococcal); 4. Pheophyte (Dictyota); 5. Filamentous Cianophyte; 6. Chlorophyle (Cladophora); 7. Pheophyte (Sphacelaria) and 8. Rodophyte (sp2).

Table 1. Components identified in the stomach contents of queen conch, *Strombus gigas*

Phyllum	Categoria	<i>Strombus gigas</i>	
		adulto	juvenil
Cianophyta	Chroococcal		X
	Gleocapsal		X
	Cianofita filamentosa sin heterocistos		
	Filamentos cenociticos	X	
Chlorophyta			
Phaeophyta	<i>Dictyota</i> sp.	X	
	<i>Padina</i> sp.	X	
Rhodophyta	<i>Champia</i> sp.		X
	<i>Laurencia</i> sp.	X	
	Rhodomelaceae		X
	Roja sp. 1		X
Antophyta	Roja sp. 2	X	
	Pasto marino	X	X
	Protozoarios		X
	Foraminiferos	X	X
Protozoa	Radiolario		X
	Gasterópodo	X	X
	Bivalvo	X	X
	Copépodo		X
Artropoda	Anfípodo	X	
	Briozoario	X	X
Bryozoa	Arena	X	X
	Fragmentos calcificados	X	X
	No identificados	X	X

Table 2. Weight (g) of the recognized groups found in the stomach contents of queen conch, *Strombus gigas*

Categoria	<i>Strombus gigas</i>		
	adulto		juvenil
	1	2	1
Algas filamentosas		0.15	
Algas parenquimatosas	0.05	<0.01	
Pasto	0.82		
Moluscos		0.01	0.01
Crustaceos	<0.01		
Briozoarios		0.01	
Fragmentos quitinosos			0.04
Arena y fragmentos menores a 700 µm	0.49	1.85	
Fragmentos calcificados mayores a 700 µm	0.11	0.45	0.02
Material no identificado		0.48	



Figure 1. Animals in stomach contents of conchs. 1. Bryozoa, 2. Ostracoda, 3. Protozoario euglenoide, 4. Protozoario flagelado, 5. Protozoa, 6. Radiolario and 7. Foraminifero

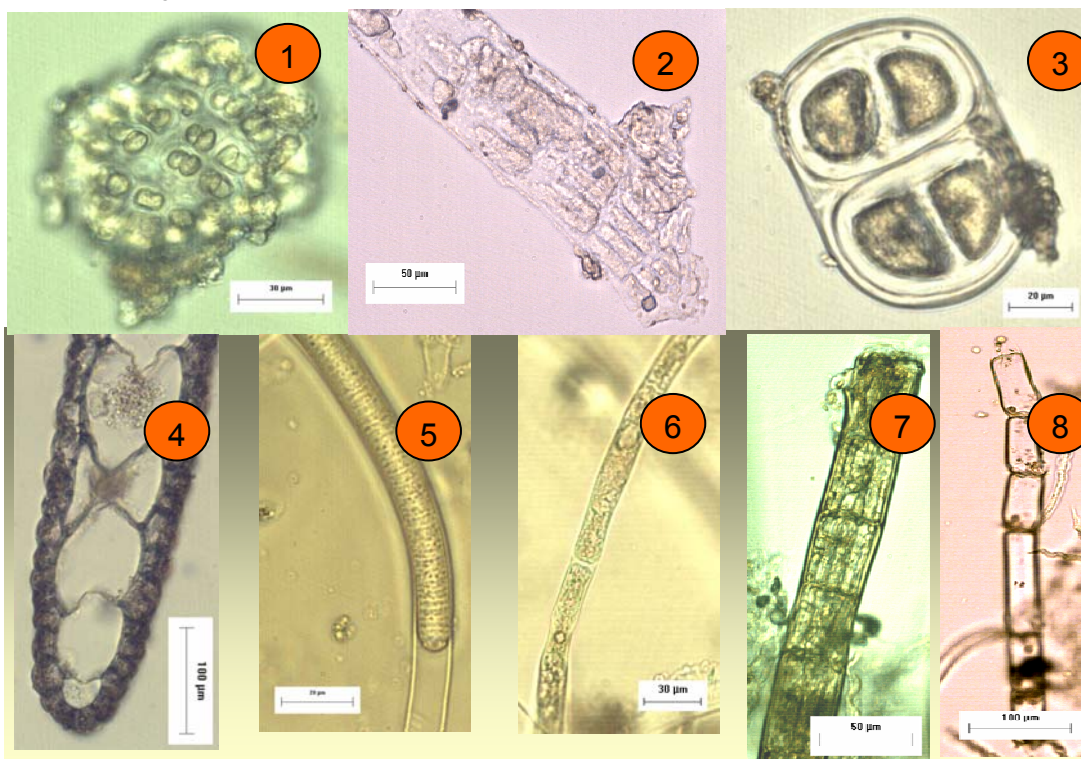


Figure 2. Plants in stomach contents of conchs. 1. Cianofita tipo Gleocapsal, 2. Rodofita – Rhodomet, 3. Cianofita (Chroococcal), 4. Feofita (Dictyota), 5. Cianofita filamentosa, 6. Clorofila (Cladophora), 7. Feofita (Sphacelaria) and 8. Rodofita (sp2)

DISCUSSION

The total number of items reported in this work was 22. Older and larger conch can be less selective of their habitat and they are thus found over a wider range. From this preliminary study about natural feed of queen conch in juveniles and adults stages it was possible to observe a qualitative difference in stomach contents. Analysis of the species founded in the stomachs of juvenile and adults conchs indicated that the most diverse Phylum was Rhodophyta, and the second largest groups were Cyanophyte and Protozoa. Sea grasses had an important biomass in one of the adults; they are usually dominated by *Thalassia testudinum* and *Syringodium filiforme*. Although sea grasses such as *T. testudinum* are frequently raked, it is only a complement to grazing various forms of macroalgae and detritus. Elseviere, Mazariegos and Aldana Aranda (Unpublished data) studied the natural feed of *Strombus pugilis* from the Yucatan Peninsula reporting a total number of 26 items in stomach contents, of which 22 were present in conch adults and 10 in juveniles. The largest groups were unicellular Cyanophytes and filamentous Cyanophyte and diatom algae. The second largest group was protozoa euglenoidea and flagellate, foraminiferos and radiolarios. Most of the animals found in the stomachs were epibionts of algae and sea grass, such as bryozoans, small mollusks, and crustaceans. Little (1965) reported that some of the most common macro algae ingested by conchs are *Cladophora sp.*, *Hypnea cervicornis*, and *Polysiphonia sp.* However, the dominant plants of a particular habitat tend to be the principle foods. The diet of conchs also changes with feed patterns, seasonal migrations offshore and nearshore. These results could permit to adjust better the feed formulation and the frequency of feeding to the real need of organism according to their age and size. These data to help to adjust better the feed formulation and the frequency of feeding to the real need of organism according to their age and size.

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